Democratizing Geospatial Modelling:

The Möbius Modellig Platform

Patrick Janssen

Design Automation Lab

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2016: Geo-computational Workflows
2018: Urban Prototyping
Open Data
Design Methods and Tools
Democratizing Methods and Tools
Möbius Platform
Möbius Parametric Modeller
Möbius Geospatial Modeller
Extruded Cities: Students
Next Work
Future Work

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2018: Urban Prototyping

Open Data

Design Methods and Tools

Democratizing Methods and Tools

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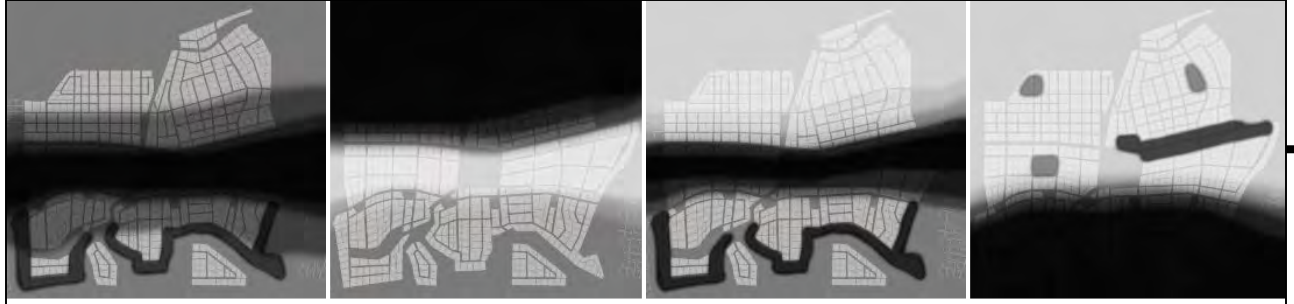
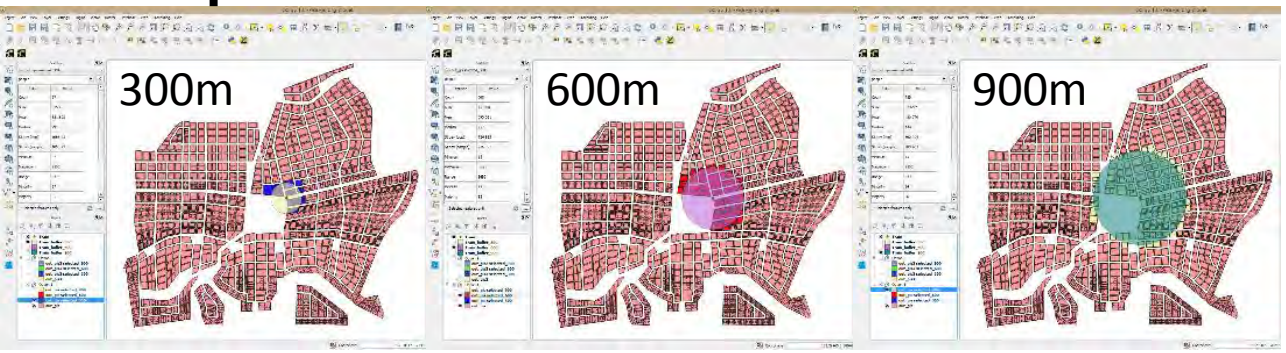
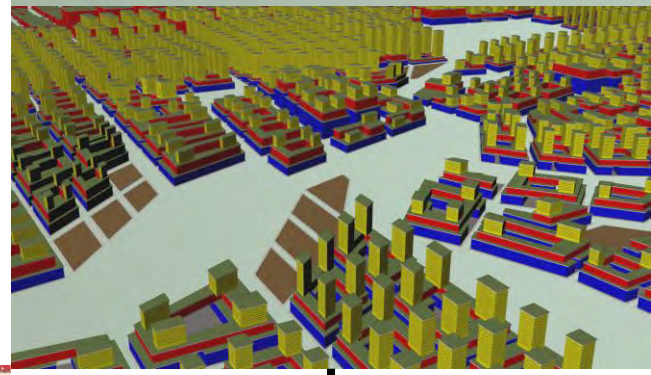
Future Work

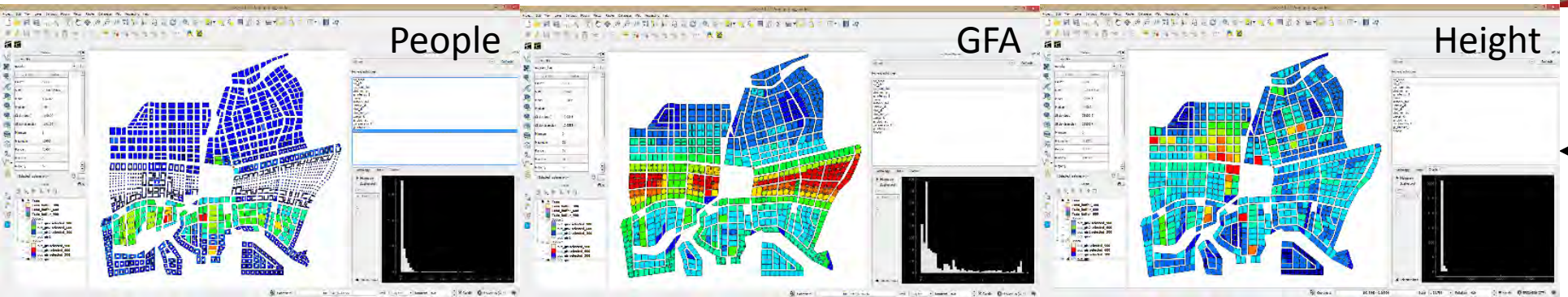
Option 1



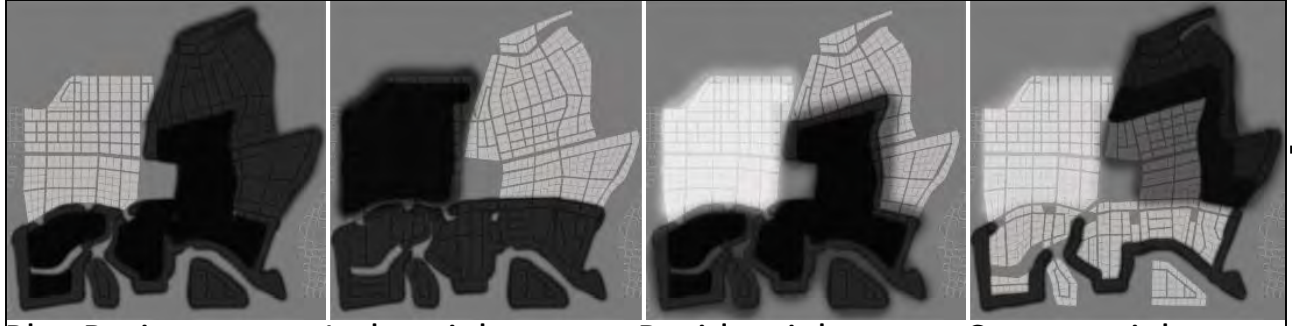
Total (residents): 910,000
300m buffer: 1% of residents
600m buffer: 6% of residents
900m buffer: 14% of residents



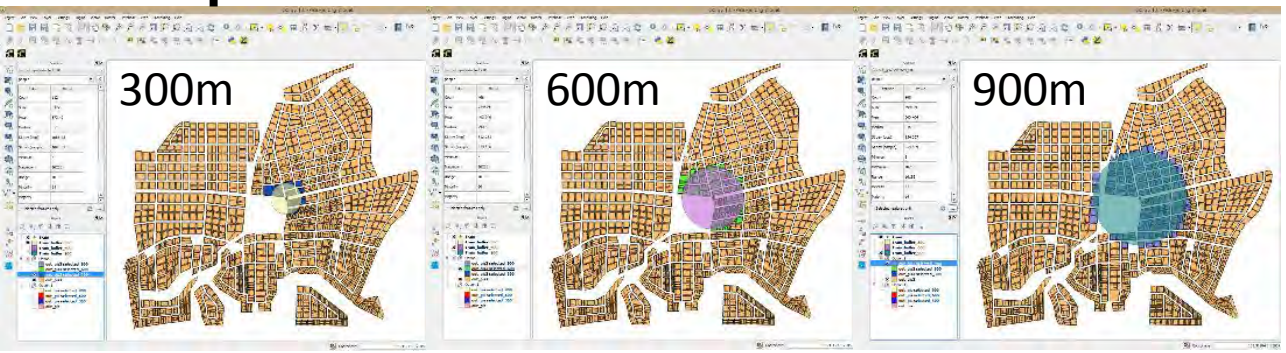


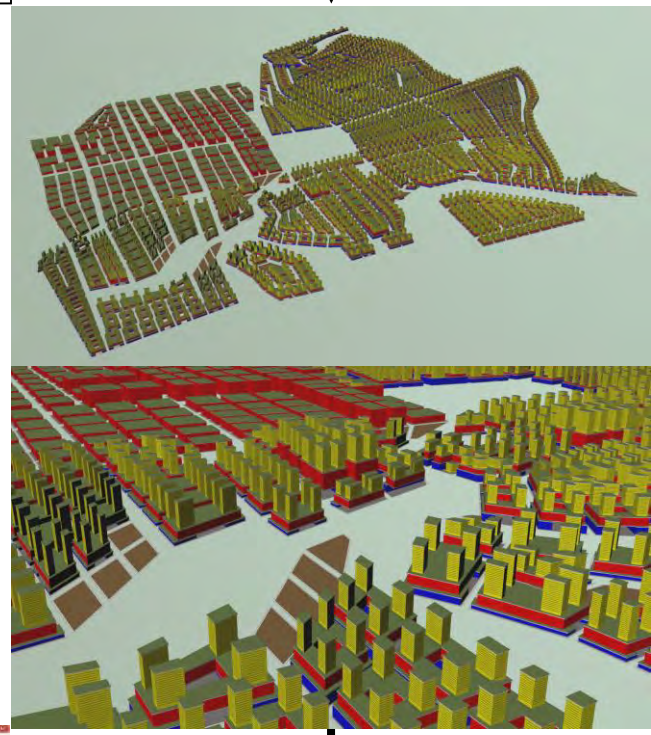


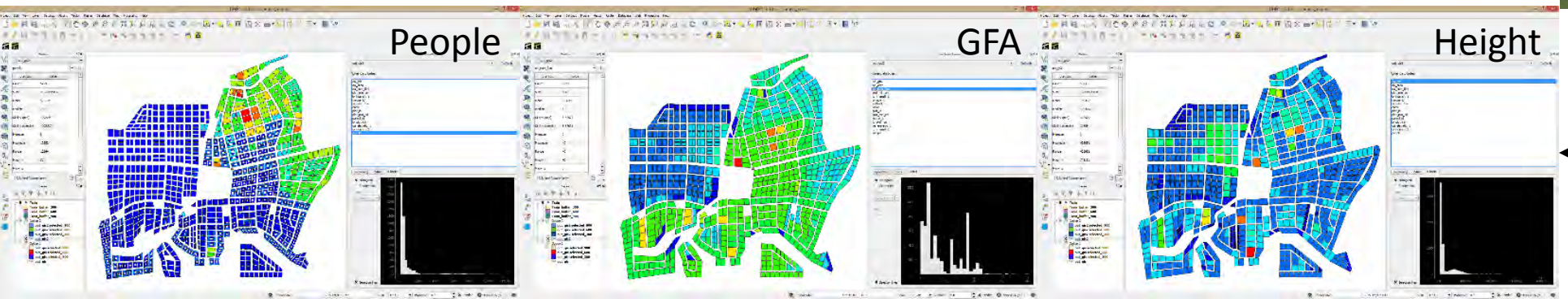
Option 2



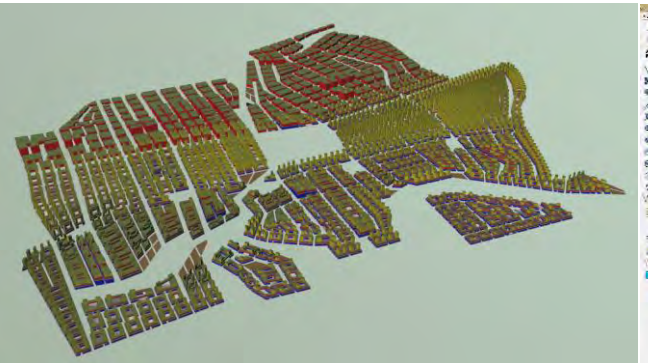
Total (residents): 650,000
300m buffer: 2% of residents
600m buffer : 9% of residents
900m buffer : 20% of residents

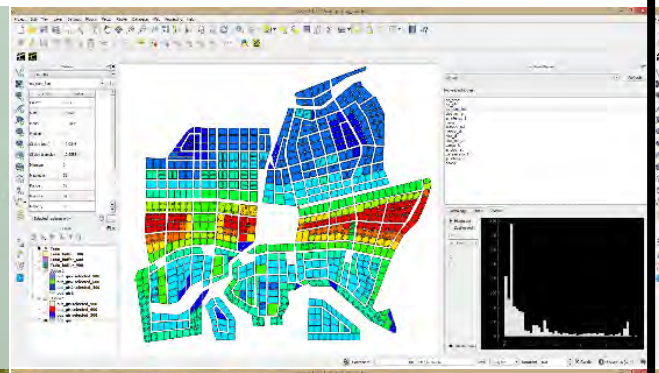


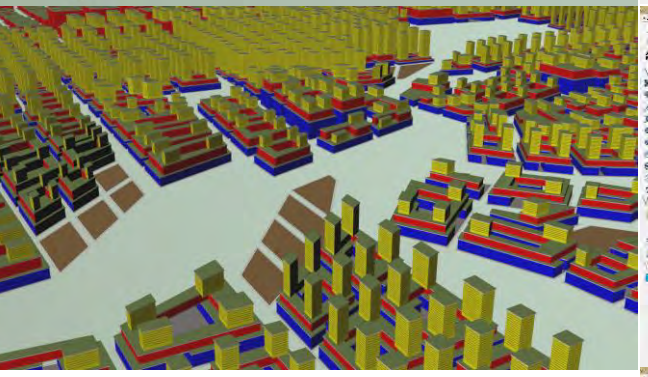


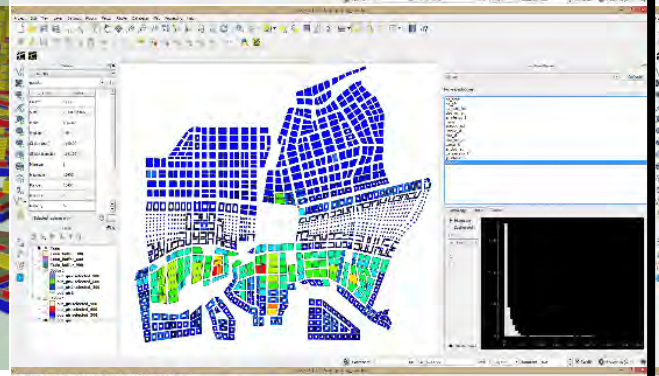


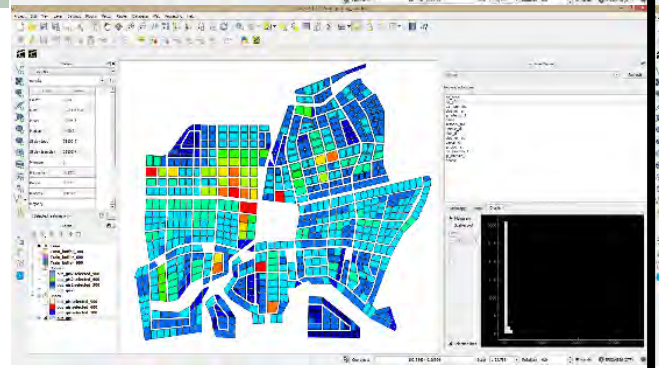
Option 1











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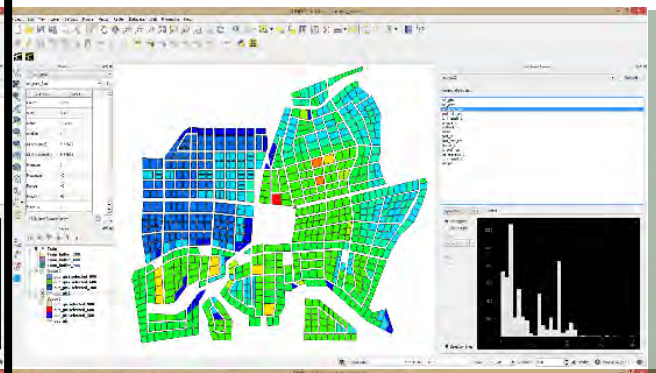

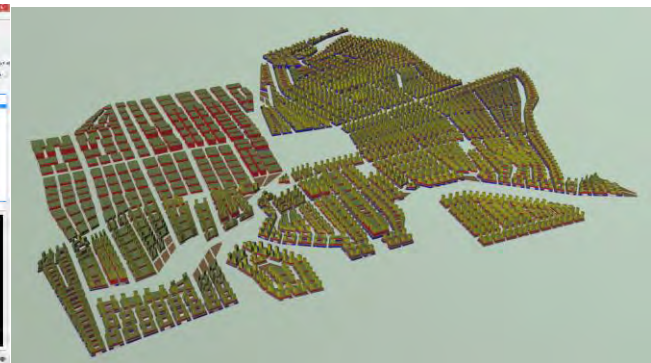

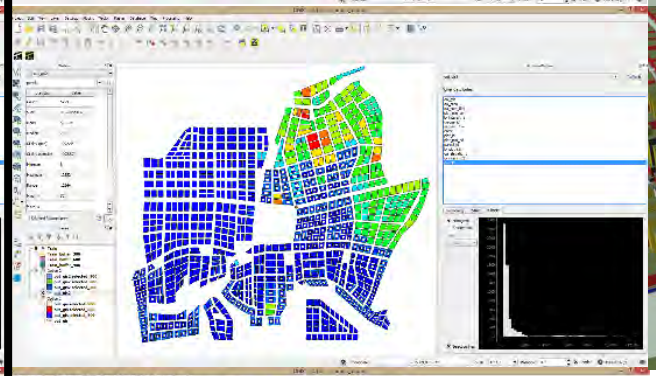

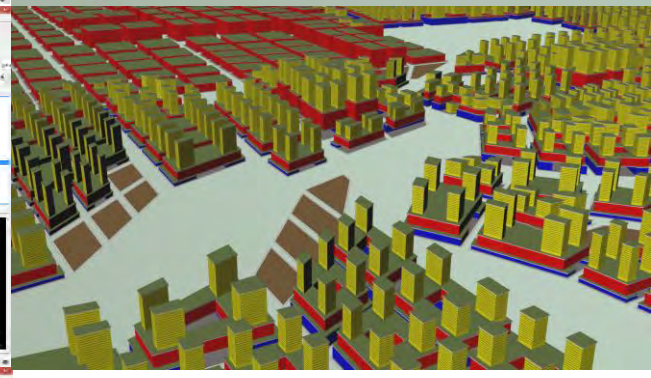

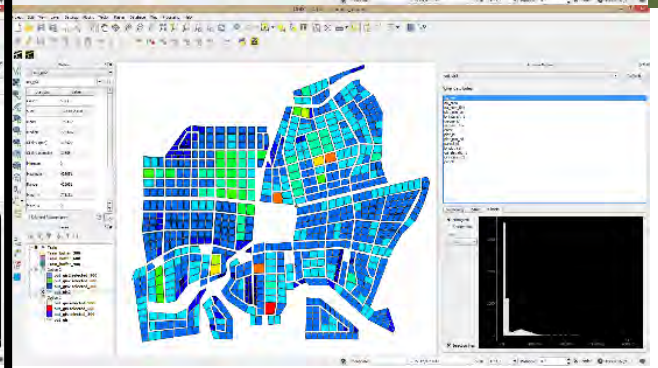

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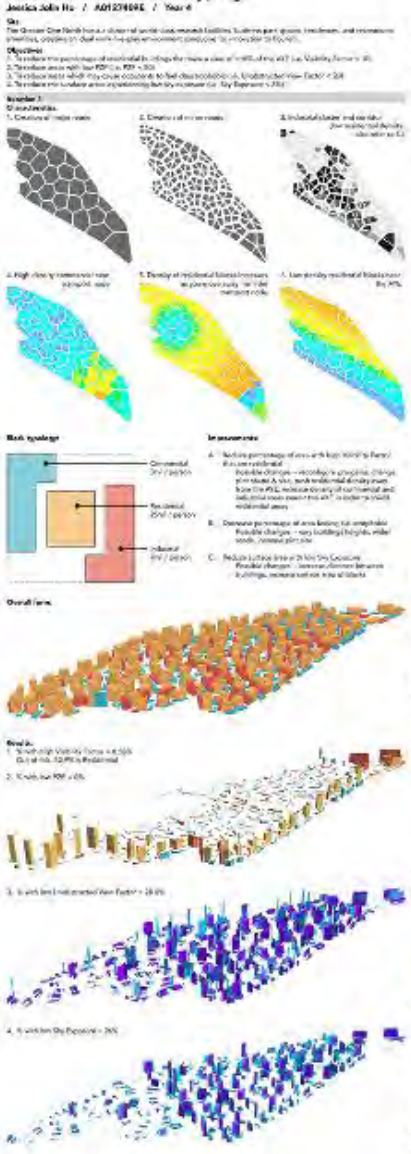
Extruded Cities: Students

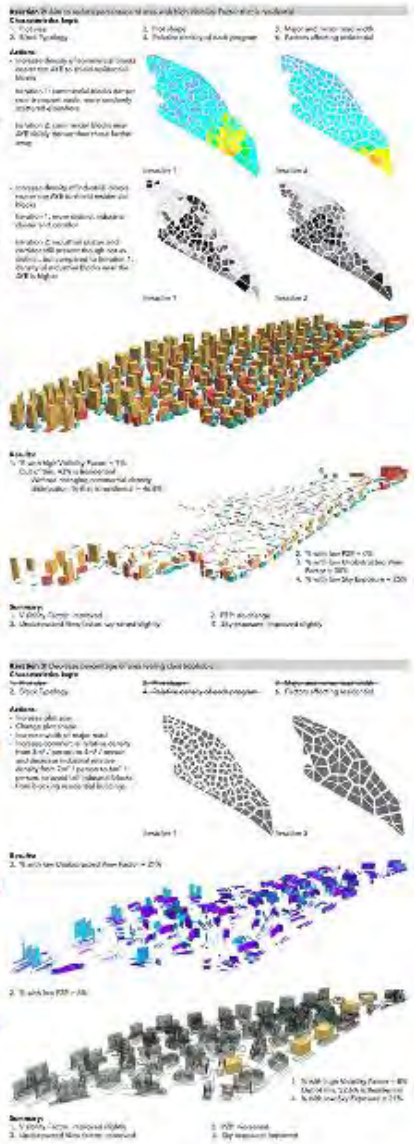
Next Work

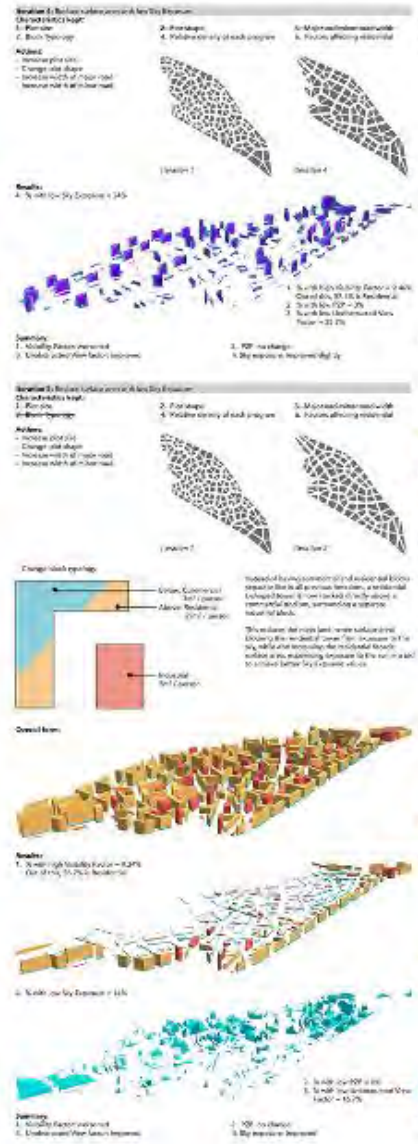
Future Work

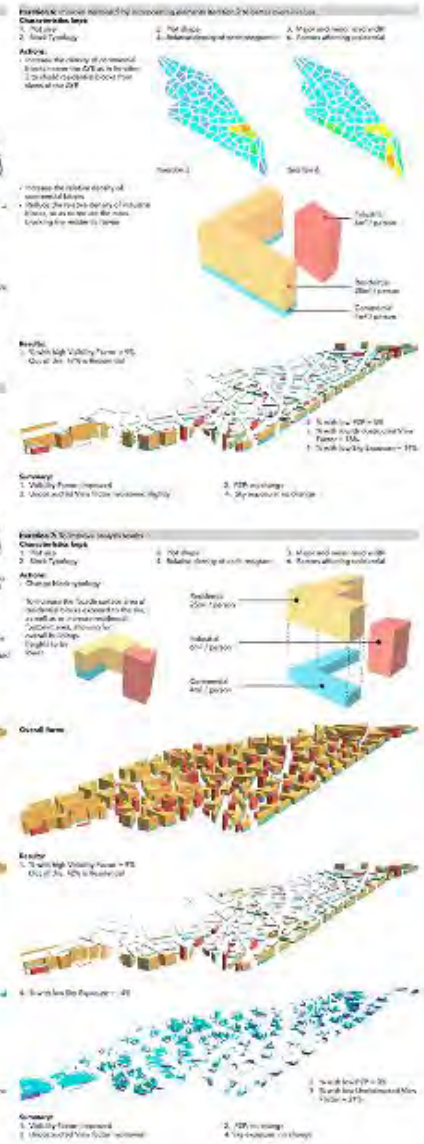
AR5953a: Urban Prototyping

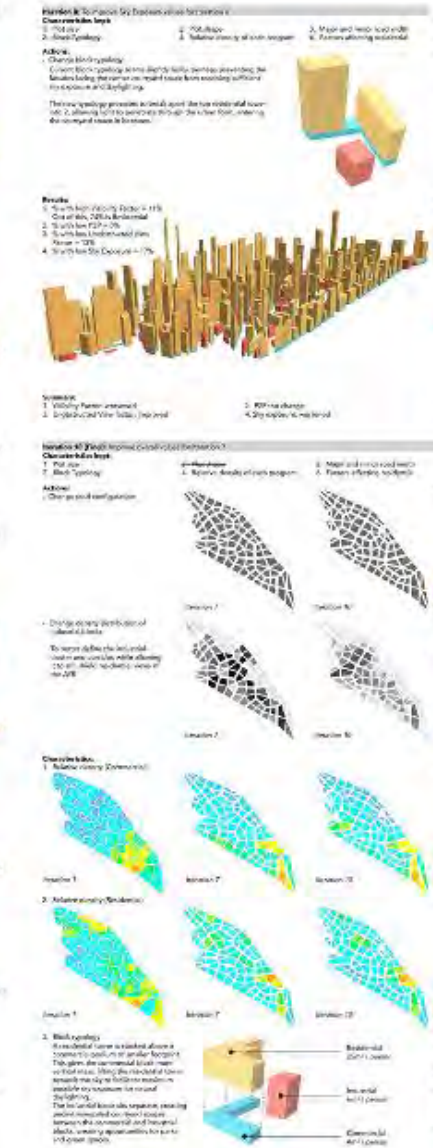
Jessica Jolin Ho / A0123489E / Year 4

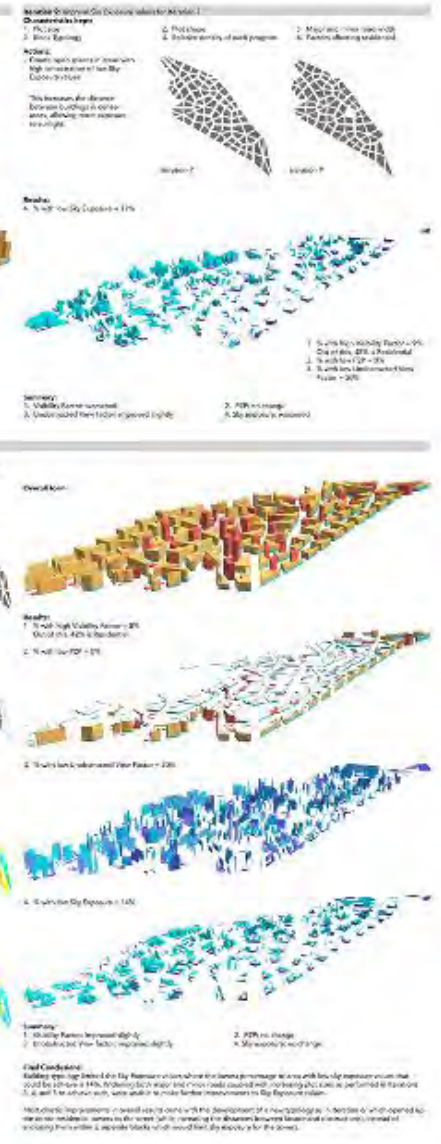










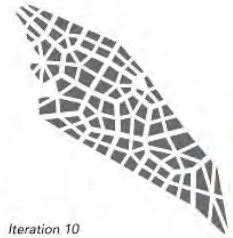


Iteration 10 (Final): Improve overall values for Iteration 7

Characteristics kept:
1. Plot size
2. ~~Plot shape~~
3. Major and minor road width
4. Relative density of each program
6. Factors affecting residential

Actions:
- Change road configuration

Iteration 7



Iteration 10

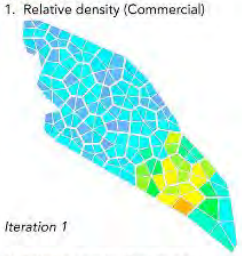
- Change density distribution of industrial blocks

  To better define the industrial cluster and corridor, while allowing it to still shield residential views of the AYE

Iteration 7

Iteration 10

Characteristics:
1. Relative density (Commercial)



Iteration 1

Iteration 7

Iteration 10

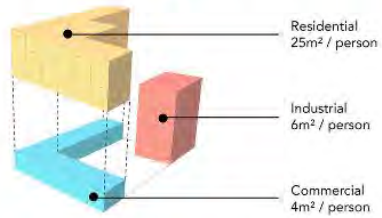
2. Relative density (Residential)

Iteration 1

Iteration 7

Iteration 10

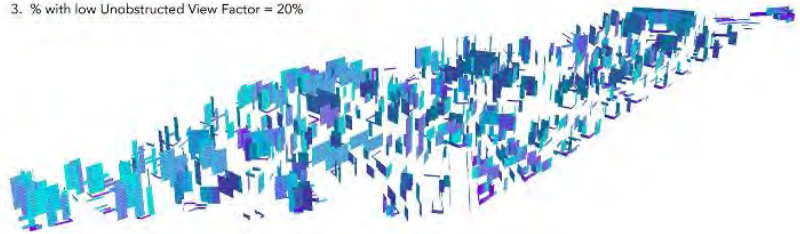
3. Block typology
   A residential tower is stacked above a commercial podium of smaller footprint. This gives the commercial block more vertical mass, lifting the residential tower towards the sky to facilitate maximum possible sky exposure for natural daylighting.
   The industrial block sits separate, creating pedestrian-scaled courtyard spaces between the commercial and industrial blocks, creating opportunities for parks and green spaces.



Overall form:

Results:
1. % with high Visibility Factor = 8%
   Out of this, 42% is Residential
2. % with low PZP = 0%

3. % with low Unobstructed View Factor = 20%



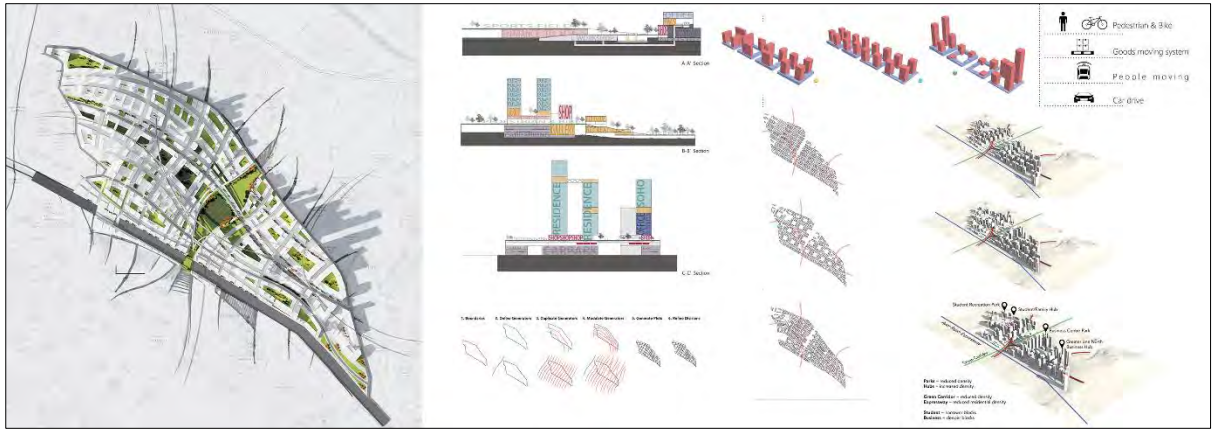
4. % with low Sky Exposure = 14%

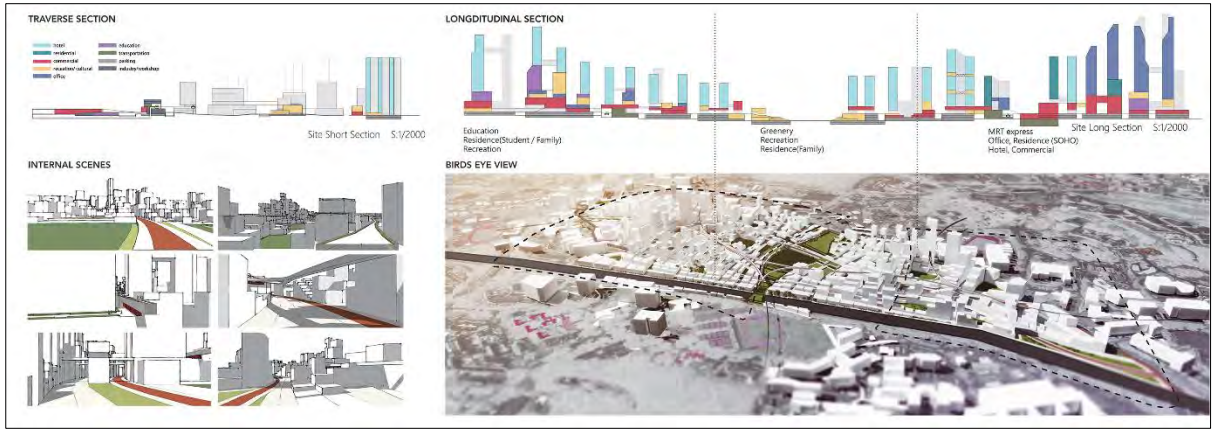
Summary:
1. Visibility Factor: improved slightly
2. PZP: no change
3. Unobstructed View factor: improved slightly
4. Sky exposure: no change

Final Conclusions:
Building typology limited the Sky Exposure values where the lowest percentage of area with low sky exposure values that could be achieve is 14%. Widening both major and minor roads coupled with increasing plot sizes as performed in Iterations 3, 4, and 5 to achieve such, were unable to make further improvements to Sky Exposure values.

Most drastic improvements in overall results came with the development of a new typology as in Iteration 6, which opened up the dense residential towers to the street (while increasing the distances between facade and obstructions), instead of enclosing them within 2 separate blocks which would limit sky exposure for the towers.


Green Spaces
& Bridging Network
Blending of Functions
Between Zones
Transport Networks
& Intermodal Nodes
PERCOLATE
Group B
YANG XIAO, WONG KEE CHANG, SOH QIANYU, HONG YU


Pedestrian & Bike
Goods moving system
People moving
Car drive
RESIDENCE
RESIDENCE
SOHO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LONGDITUDINAL SECTION
Education
Residence(Student / Family)
Recreation
Greenery
Recreation
Residence(Family)
MRT express
Office, Residence (SOHO)
Hotel, Commercial
Site Long Section S:1/2000
INTERNAL SCENES
BIRDS EYE VIEW

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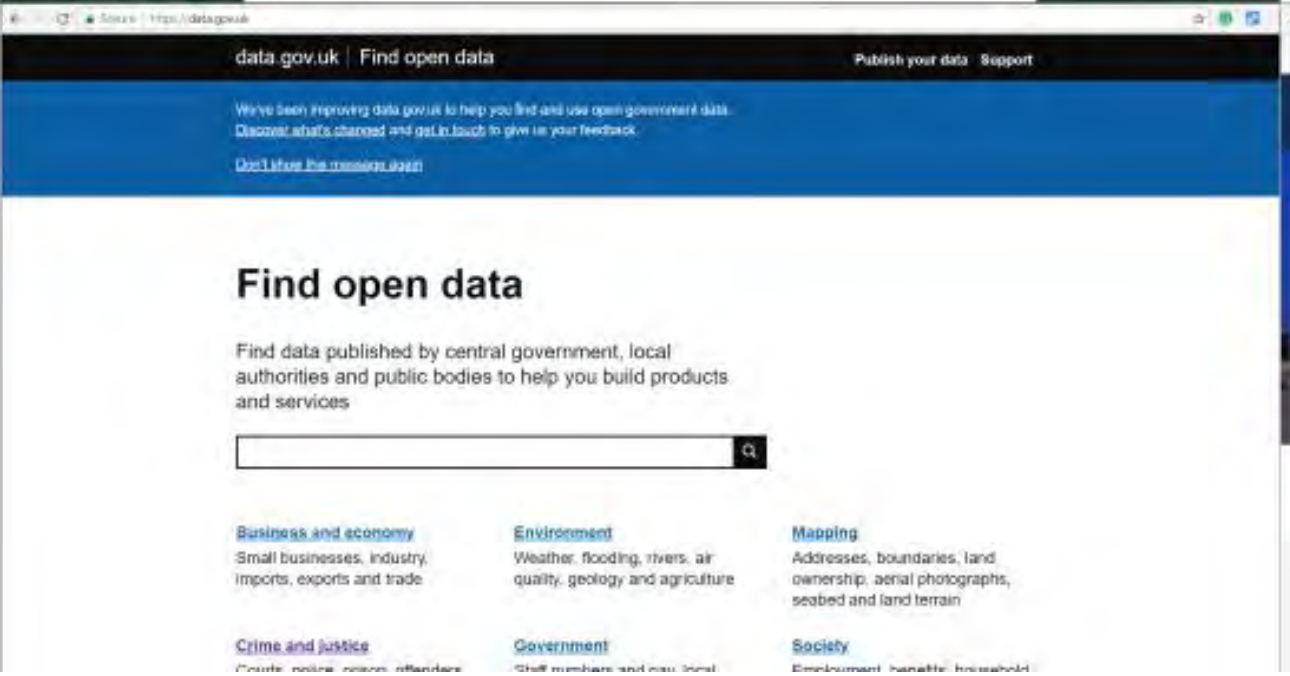
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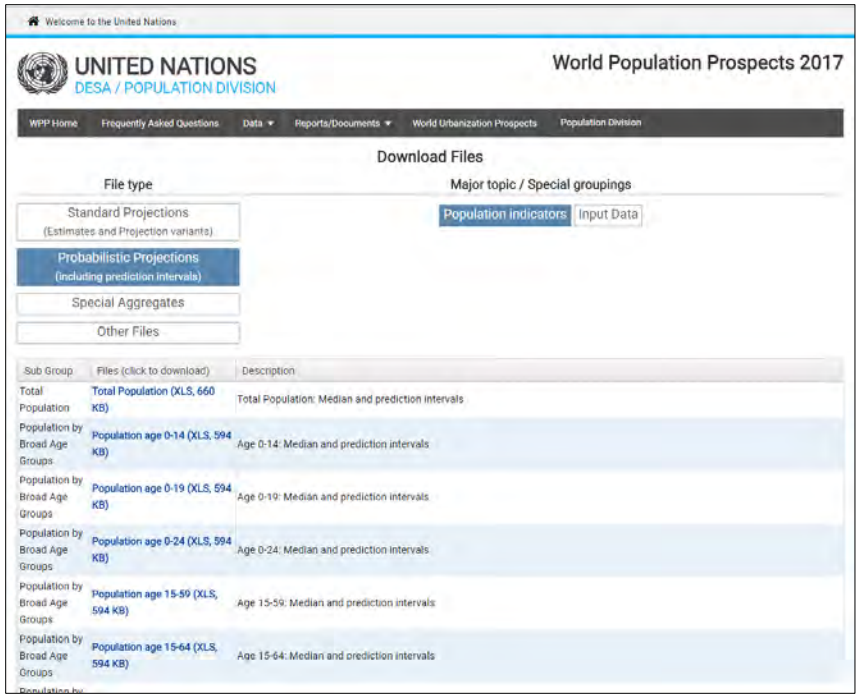
Singapore at a glance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2015
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18+ years
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Eastern Mediterranean
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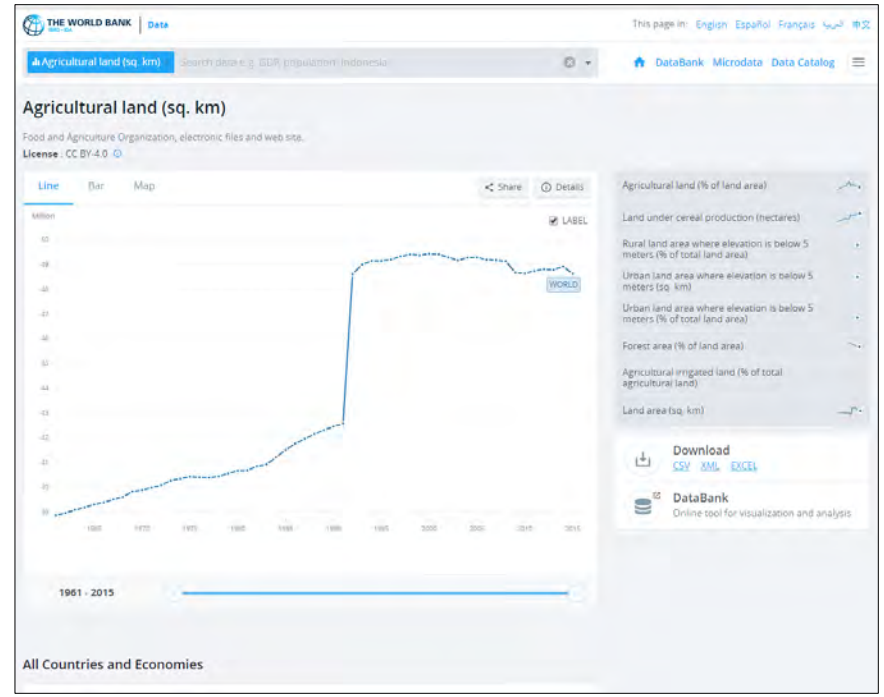
(WHO) Global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Land under cereal production (hectares)
Rural land area where elevation is below 5 meters (% of total land area)
Urban land area where elevation is below 5 meters (sq. km)
Urban land area where elevation is below 5 meters (% of total land area)
Forest area (% of land area)
Agricultural irrigated land (% of total agricultural land)
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United Nations
Population Division
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Probabilistic Population Projections based on the World Population Prospects: The 2017 Revision

)T: Probabilistic projection of total population (both sexes combined) by region, subregion, country or area, 2015-2100 (thousands)
Median (50 percent) prediction interval, 2015 - 2100
POP/DB/WPP/Rev.2017/PPP/POPTOT

ic and Social Affairs, Population Division (2017). Probabilistic Population Projections based on the World Population Prospects: The 2017 Revision. Population Division, DESA. http://esa.un.org/unpd/wpp/

Region, subregion, country or area	Notes	Country code	Total population, both sexes combined, as of 1 July (thousands)																	
			2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090	2095	2
World		900	7,383,009	7,795,482	8,185,614	8,551,199	8,892,702	9,210,337	9,504,209	9,771,823	10,011,171	10,222,598	10,409,808	10,575,846	10,721,964	10,848,708	10,957,566	11,050,055	11,126,033	11,184
More developed regions	a	901	1,253,206	1,269,277	1,281,296	1,289,937	1,295,000	1,297,496	1,298,349	1,298,069	1,296,491	1,293,887	1,290,858	1,288,199	1,286,258	1,285,254	1,284,939	1,285,091	1,285,303	1,284
Less developed regions	b	902	6,129,802	6,526,205	6,904,318	7,261,262	7,597,702	7,912,841	8,205,860	8,473,754	8,714,681	8,928,712	9,118,951	9,287,647	9,435,706	9,563,455	9,672,627	9,764,964	9,840,730	9,899
Least developed countries	c	941	956,631	1,073,984	1,200,441	1,334,196	1,474,183	1,618,984	1,767,059	1,916,742	2,066,798	2,215,712	2,362,084	2,504,276	2,640,719	2,770,009	2,891,086	3,003,212	3,105,922	3,198
Less developed regions, excluding least deve	d	934	5,173,171	5,450,815	5,702,241	5,925,195	6,121,415	6,291,508	6,436,205	6,554,168	6,644,790	6,709,664	6,753,297	6,779,583	6,790,997	6,789,270	6,777,199	6,757,260	6,730,183	6,695
Less developed regions, excluding China		948	4,701,441	5,069,640	5,432,967	5,787,196	6,131,182	6,462,522	6,779,060	7,077,398	7,354,883	7,609,339	7,840,827	8,049,437	8,235,632	8,399,843	8,542,892	8,665,641	8,768,456	8,852
High-income countries	e	1503	1,180,061	1,207,775	1,230,492	1,249,896	1,264,922	1,275,679	1,282,990	1,287,798	1,290,411	1,291,438	1,291,556	1,291,296	1,290,768	1,290,200	1,289,575	1,289,124	1,288,791	1,288
Middle-income countries	e	1517	5,558,264	5,852,576	6,121,661	6,362,054	6,576,010	6,764,840	6,929,182	7,067,079	7,177,427	7,261,389	7,323,333	7,367,298	7,395,932	7,410,952	7,415,030	7,410,319	7,397,277	7,375
Upper-middle-income countries	e	1502	2,588,363	2,670,122	2,727,929	2,767,247	2,791,446	2,802,739	2,802,574	2,790,496	2,766,438	2,732,373	2,692,123	2,649,070	2,604,849	2,560,277	2,516,759	2,475,338	2,435,973	2,397
Lower-middle-income countries	e	1501	2,969,901	3,182,454	3,393,732	3,594,807	3,784,564	3,962,101	4,126,608	4,276,584	4,410,988	4,529,016	4,631,210	4,718,229	4,791,083	4,850,676	4,898,271	4,934,981	4,961,304	4,978
Low-income countries	e	1500	641,859	732,133	830,289	935,905	1,048,262	1,166,159	1,288,244	1,413,034	1,539,320	1,665,664	1,790,727	1,912,979	2,030,917	2,143,143	2,248,492	2,346,100	2,435,424	2,516
Sub-Saharan Africa	f	947	969,234	1,106,573	1,256,240	1,418,333	1,592,399	1,776,791	1,969,331	2,167,652	2,369,757	2,573,400	2,776,710	2,977,424	3,172,936	3,360,850	3,539,194	3,706,304	3,860,830	4,001
Africa		903	1,194,370	1,352,622	1,522,250	1,703,538	1,896,704	2,100,302	2,311,561	2,527,557	2,745,926	2,964,353	3,181,161	3,394,171	3,600,798	3,798,682	3,985,887	4,160,717	4,321,658	4,467
Eastern Africa		910	399,458	457,440	520,131	587,330	658,521	732,906	809,729	888,129	967,302	1,046,331	1,124,332	1,200,512	1,273,988	1,344,006	1,409,928	1,471,197	1,527,486	1,578
Burundi		108	10,199	11,939	13,810	15,799	17,970	20,377	22,999	25,762	28,603	31,498	34,457	37,482	40,532	43,547	46,470	49,285	51,970	54
Comoros		174	777	870	965	1,062	1,161	1,262	1,363	1,463	1,559	1,652	1,740	1,822	1,898	1,967	2,028	2,081	2,125	2
Djibouti		262	927	1,000	1,069	1,133	1,189	1,237	1,276	1,308	1,331	1,346	1,353	1,351	1,343	1,331	1,316	1,300	1,282	1
Eritrea		232	4,847	5,432	6,057	6,718	7,421	8,153	8,888	9,607	10,302	10,973	11,616	12,223	12,783	13,291	13,745	14,145	14,491	14
Ethiopia		231	99,873	112,759	126,121	139,620	153,036	166,139	178,818	190,870	202,083	212,279	221,318	229,097	235,571	240,712	244,580	247,235	248,837	249
Kenya		404	47,236	53,492	60,063	66,960	74,086	81,287	88,434	95,467	102,303	108,839	114,980	120,634	125,717	130,208	134,107	137,384	140,049	142
Madagascar		450	24,234	27,691	31,500	35,592	39,891	44,368	49,013	53,803	58,687	63,595	68,473	73,274	77,946	82,452	86,742	90,777	94,540	98
Malawi		454	17,574	20,284	23,277	26,578	30,110	33,837	37,719	41,705	45,752	49,799	53,785	57,643	61,315	64,760	67,945	70,838	73,429	75
Mauritius	1	480	1,259	1,274	1,283	1,287	1,283	1,269	1,248	1,221	1,193	1,166	1,138	1,109	1,079	1,047	1,016	985	957	
Mayotte		175	240	273	308	344	382	420	459	495	531	565	596	626	653	678	699	718	732	
Mozambique		508	28,011	32,309	37,116	42,439	48,242	54,443	60,975	67,775	74,811	82,012	89,284	96,544	103,699	110,667	117,360	123,688	129,614	135
Réunion		638	863	897	928	957	981	999	1,009	1,014	1,013	1,009	1,004	999	993	986	978	967	953	
Rwanda		646	11,630	13,087	14,544	16,024	17,543	19,066	20,529	21,886	23,127	24,254	25,257	26,122	26,834	27,390	27,797	28,059	28,184	28
Seychelles		690	94	96	97	98	98	98	98	97	95	93	91	89	88	86	85	83	82	
Somalia		706	13,908	16,105	18,666	21,535	24,700	28,146	31,869	35,852	40,050	44,410	48,876	53,406	57,953	62,460	66,868	71,127	75,171	78
South Sudan		728	11,882	13,610	15,395	17,254	19,183	21,189	23,257	25,366	27,489	29,590	31,641	33,614	35,488	37,246	38,867	40,335	41,643	42
Uganda		800	40,145	47,188	55,085	63,842	73,386	83,605	94,407	105,698	117,362	129,233	141,153	152,985	164,580	175,781	186,426	196,378	205,526	213
United Republic of Tanzania	2	834	53,880	62,775	72,681	83,702	95,862	109,060	123,174	138,082	153,731	170,043	186,861	204,040	221,357	238,624	255,675	272,358	288,475	303
Zambia		894	16,101	18,679	21,594	24,859	28,441	32,327	36,517	41,001	45,764	50,751	55,936	61,286	66,771	72,346	77,948	83,525	89,028	94
Zimbabwe		716	15,777	17,680	19,571	21,527	23,556	25,626	27,678	29,659	31,517	33,226	34,775	36,164	37,387	38,425	39,275	39,930	40,398	40
Middle Africa		911	153,743	178,959	206,961	237,771	271,315	307,221	344,941	384,005	424,052	464,653	505,458	545,864	585,317	623,362	659,488	693,348	724,637	753
Angola		24	27,859	32,827	38,431	44,712	51,665	59,249	67,399	76,046	85,132	94,596	104,371	114,365	124,463	134,553	144,540	154,311	163,784	172
Cameroon		120	22,835	25,958	29,339	32,980	36,884	41,021	45,351	49,817	54,374	58,965	63,553	68,104	72,562	76,875	80,989	84,845	88,403	91
Central African Republic		140	4,546	4,921	5,489	6,124	6,798	7,481	8,166	8,851	9,538	10,219	10,877	11,498	12,067	12,579	13,035	13,433	13,774	14
Chad		148	14,009	16,285	18,776	21,460	24,317	27,321	30,439	33,636	36,878	40,132	43,357	46,506	49,532	52,400	55,072	57,522	59,733	61

https://esa.un.org/unpd/wpp/Download/Probabilistic/Population/

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Extruded Cities: Students
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Future Work


Asia


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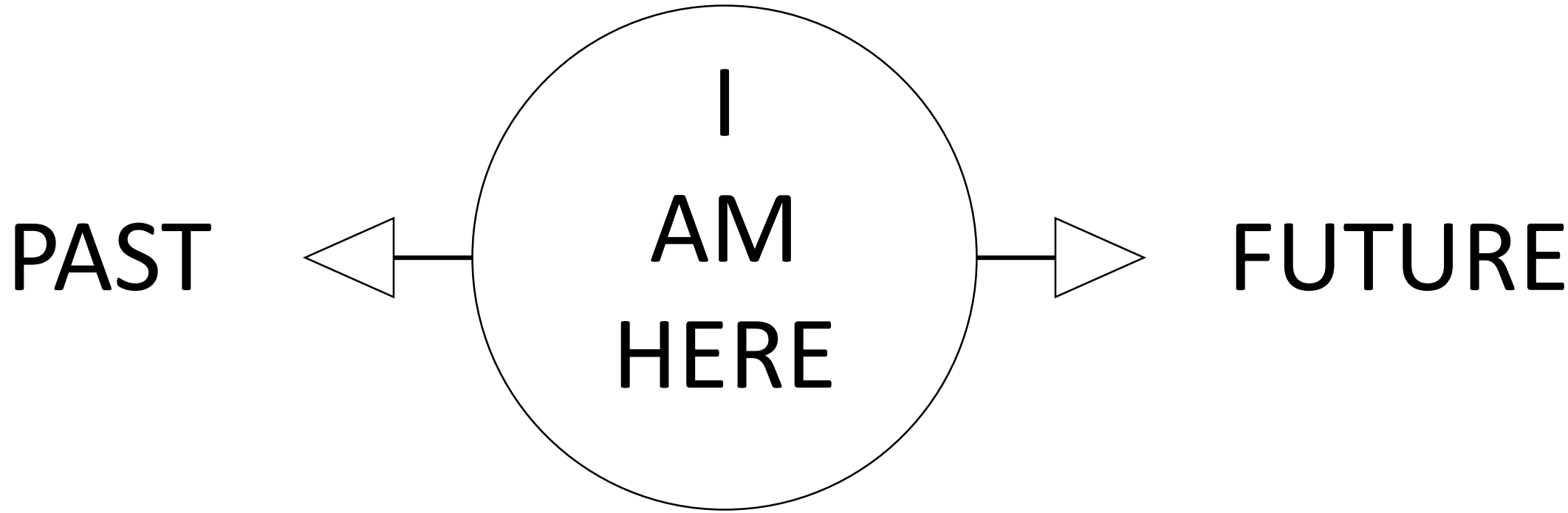
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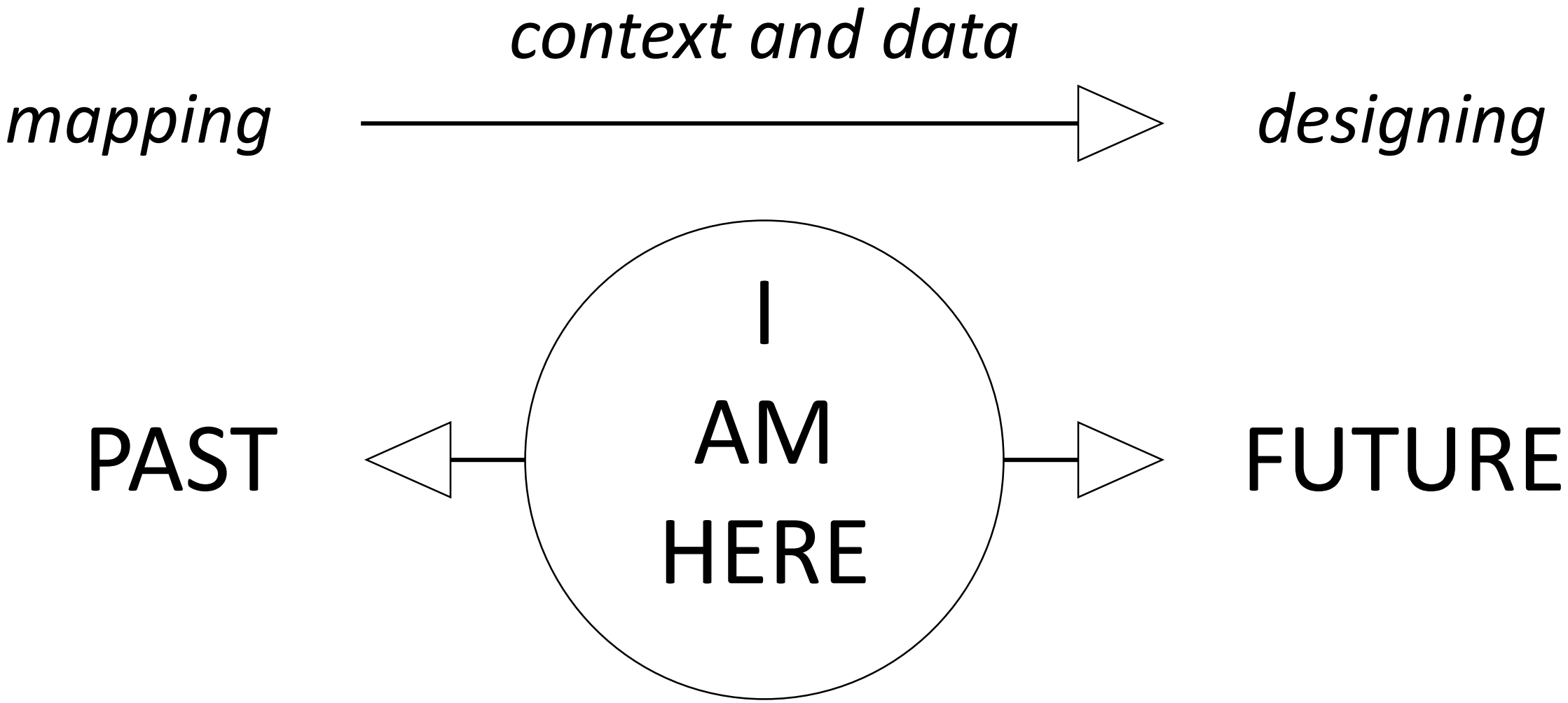
context and data
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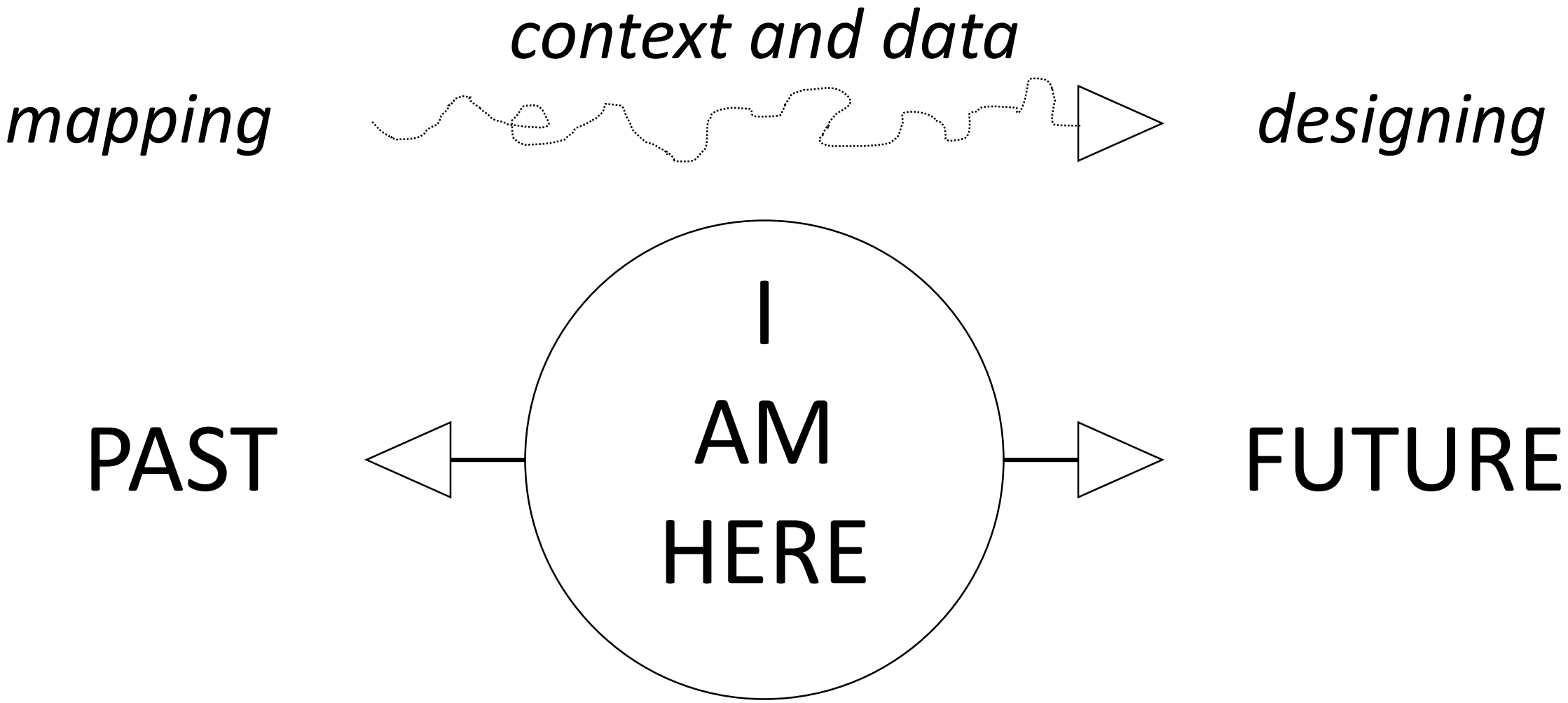
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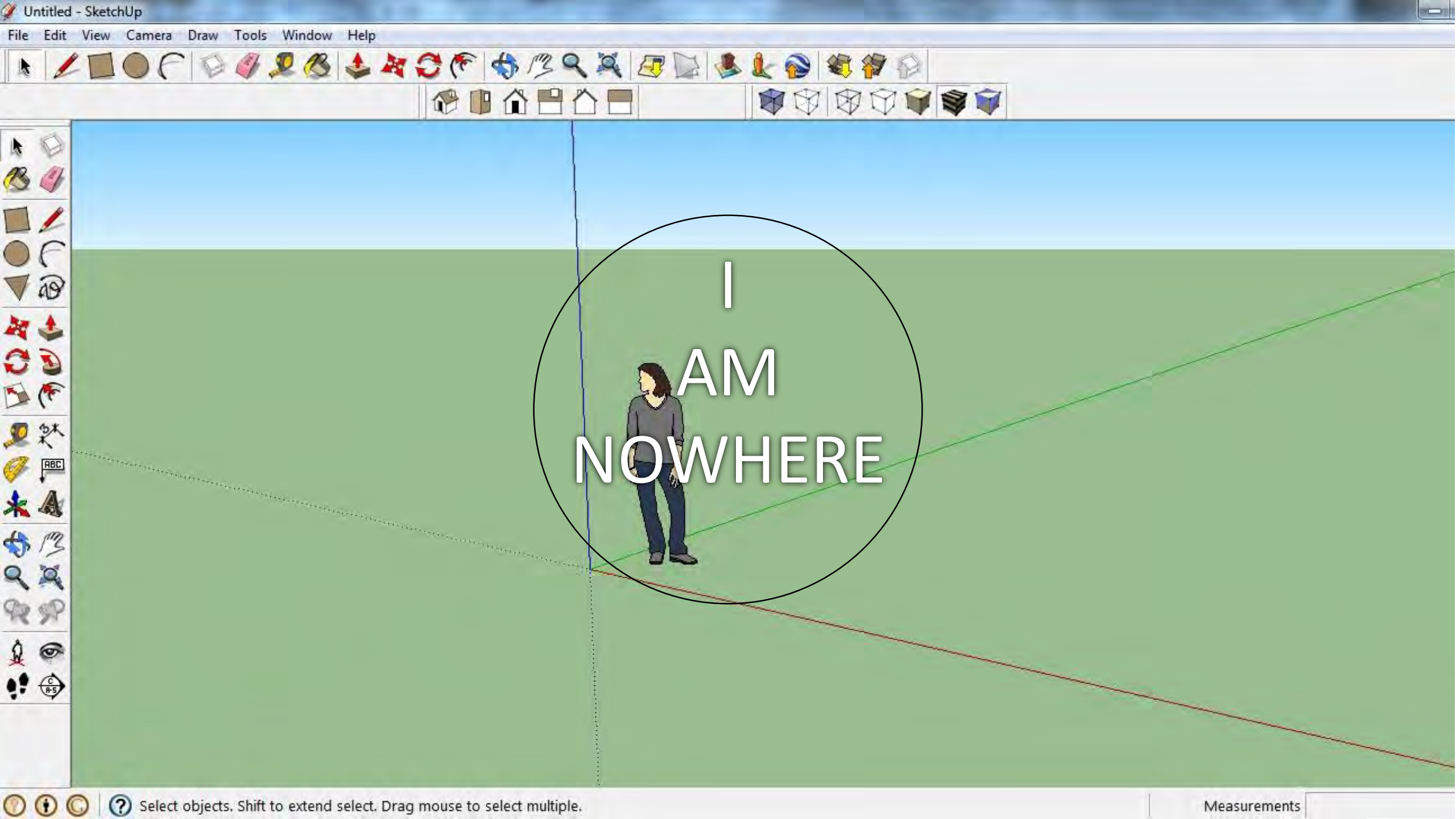
Untitled - SketchUp
File Edit View Camera Draw Tools Window Help
I
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NOWHERE
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements

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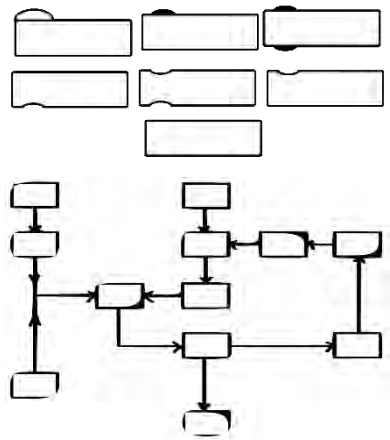
Users	Professionals	Skill Requirement
 Specialists	CAD managers, CAD Researchers, Geo-Informatics Researchers … etc.	Programmer
 General Users	Architects, Urban Designers, Planners, Geographers … etc.	Naïve Programmer
 Viewers	Clients, Citizens … etc.	Non-Programmer

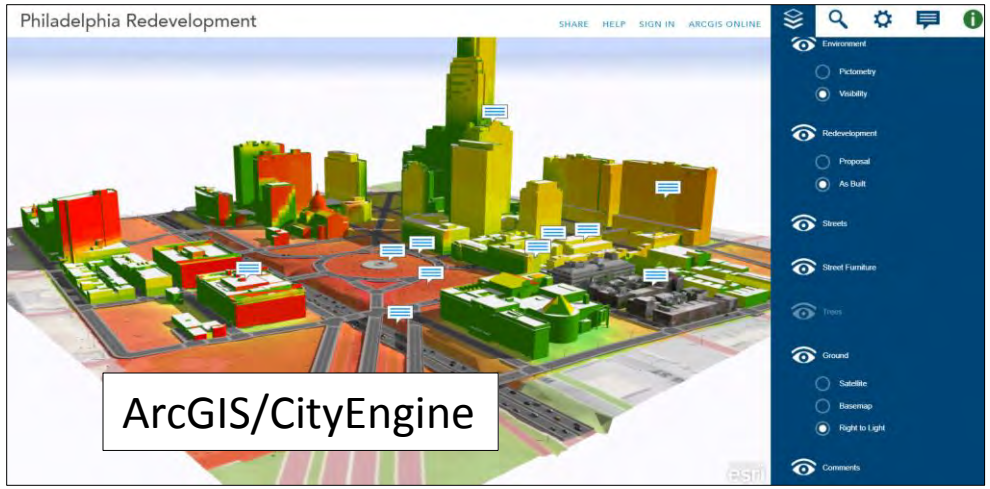
GIS-Ready

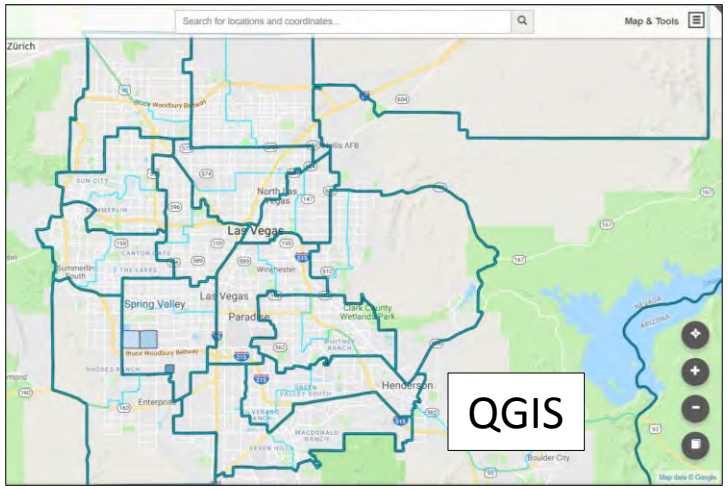


Visual Programming

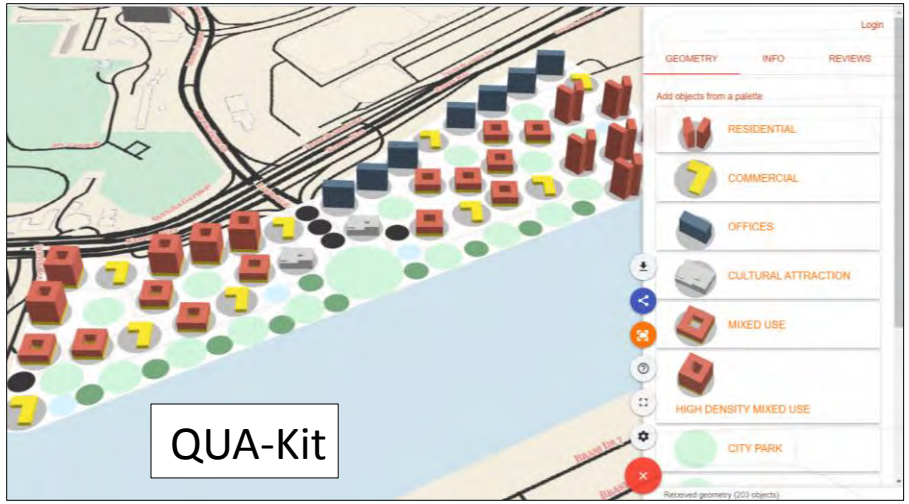
Web Publication

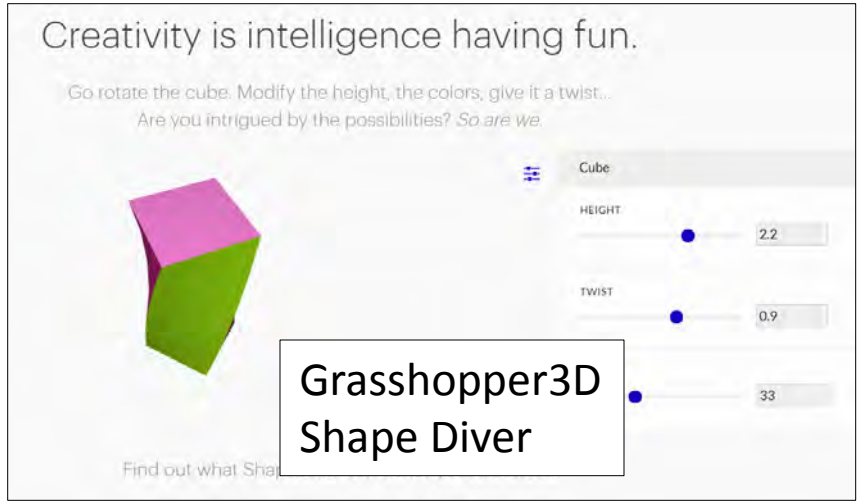
3D Modelling

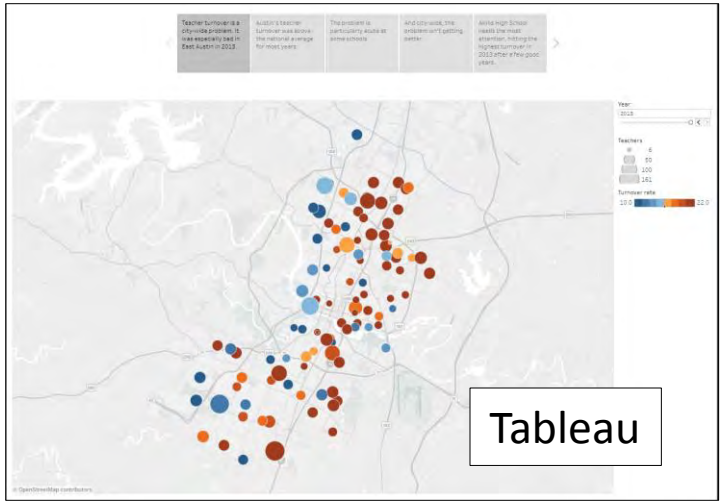

Philadelphia Redevelopment
SHARE
HELP
SIGN IN
ARCGIS ONLINE
Environment
Pictometry
Visibility
Redevelopment
Proposal
As Built
Streets
Street Furniture
Trees
Ground
Satellite
Basemap
Right to Light
Comments
ArcGIS/CityEngine


Search for locations and coordinates...
Map & Tools
Zürich
Las Vegas
Spring Valley
Paradise
Henderson
QGIS


START
VÄGEN
HILLEVÅGSBUKTA
LERVIK
MADICA
JÄTTAVÄGEN
HAVNIVÅ
HAVNIVÅ
CityPlanner


Login
GEOMETRY
INFO
REVIEWS
Add objects from a palette
RESIDENTIAL
COMMERCIAL
OFFICES
CULTURAL ATTRACTION
MIXED USE
HIGH DENSITY MIXED USE
CITY PARK
QUA-Kit


Creativity is intelligence having fun.
Go rotate the cube. Modify the height, the colors, give it a twist...
Are you intrigued by the possibilities? So are we.
Cube
HEIGHT
2.2
TWIST
0.9
33
Grasshopper3D
Shape Diver



Tableau

Software	Type	Visual Programming	Online Publishing	3D Modelling
ArcGIS	GIS	Dataflow	Yes – Upload to ArcGIS Online	Yes - Rudimentary
CityEngine	GIS	-	Yes – Upload to ArcGIS Online	Yes - CAD Modelling Capability
QGIS	GIS	-	Yes – Upload to QGIS Online	Yes – QGIS3
CityPlanner	GIS	-	Yes – Web-based tool	Yes – Rudimentary
QUA-Kit	GIS	-	Yes – Web-based tool	Yes - Rudimentary
Grasshopper3D	CAD/ GIS (ad-hoc)	Dataflow	Yes- ad-hoc	Yes – CAD Modelling Capability
Tableau	GIS	-	Yes	-

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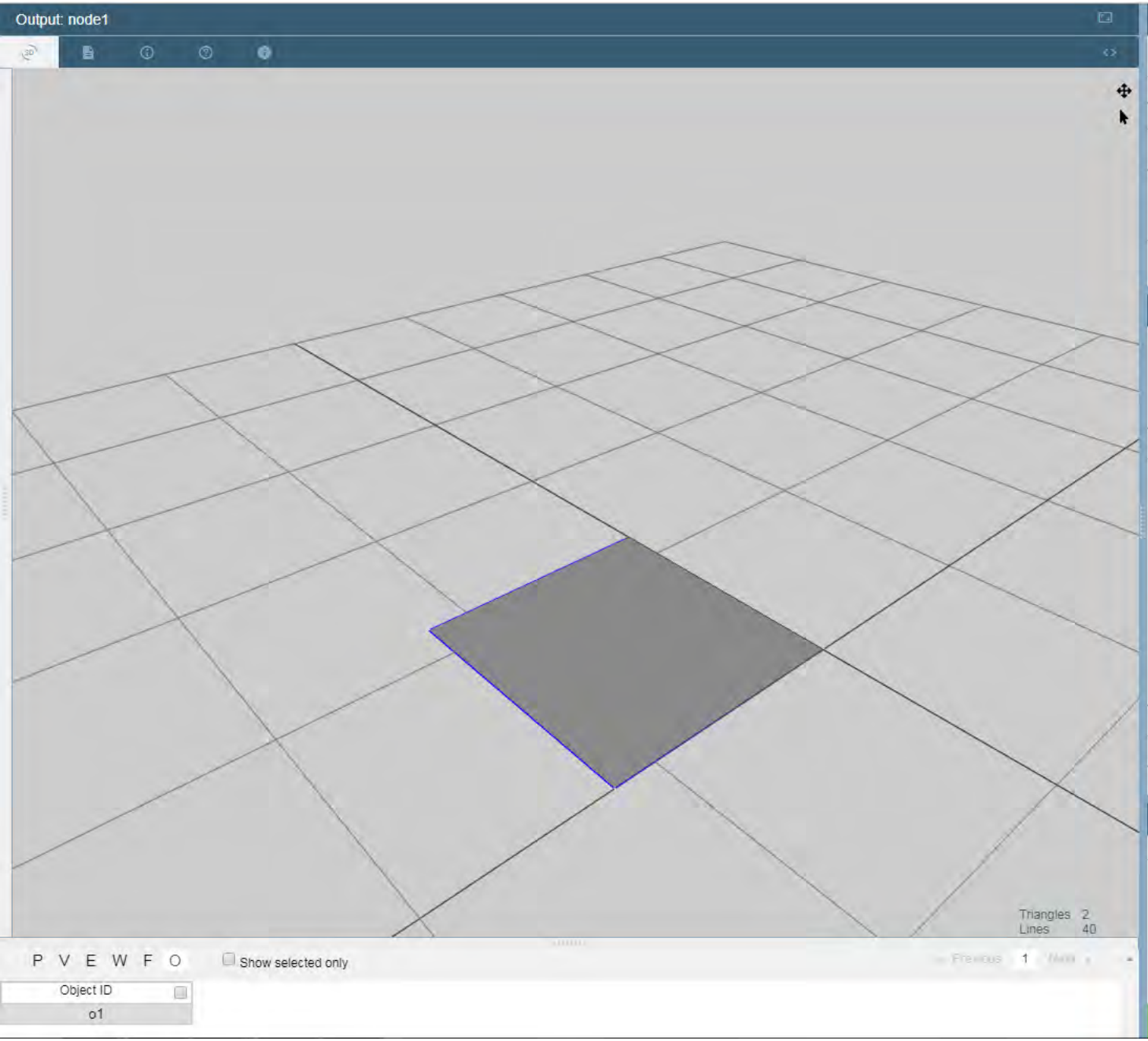
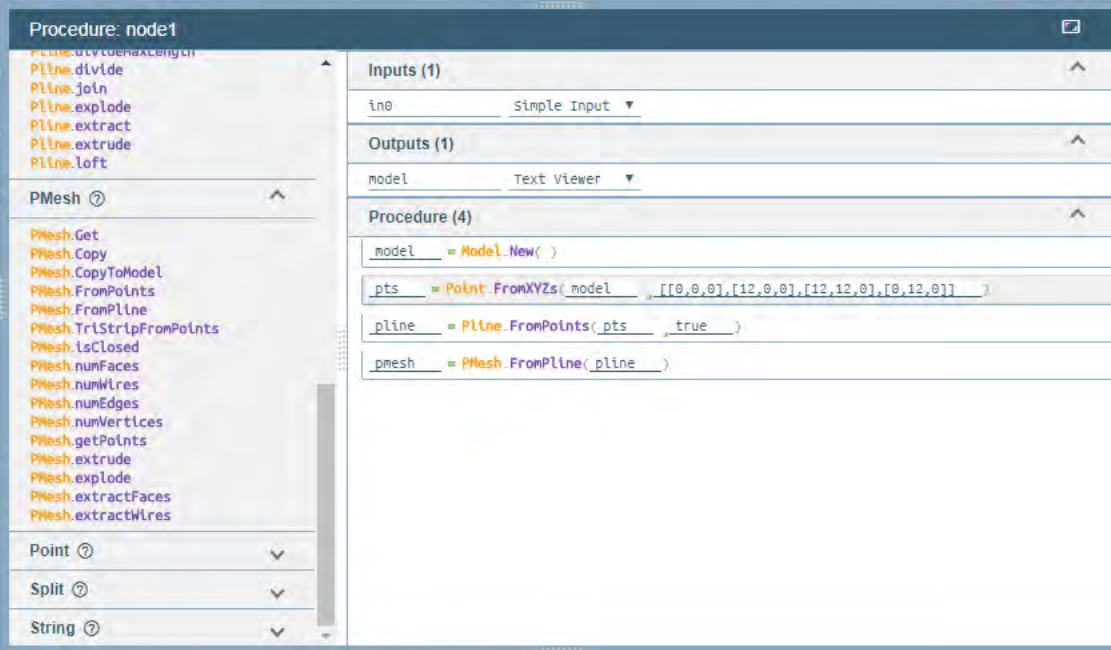
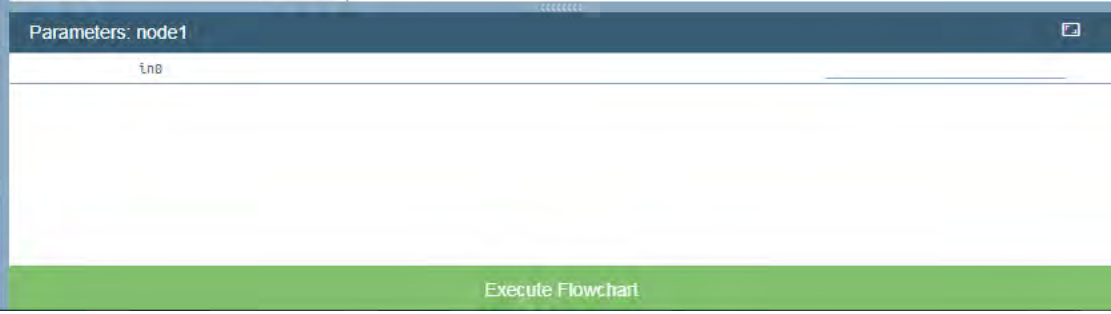
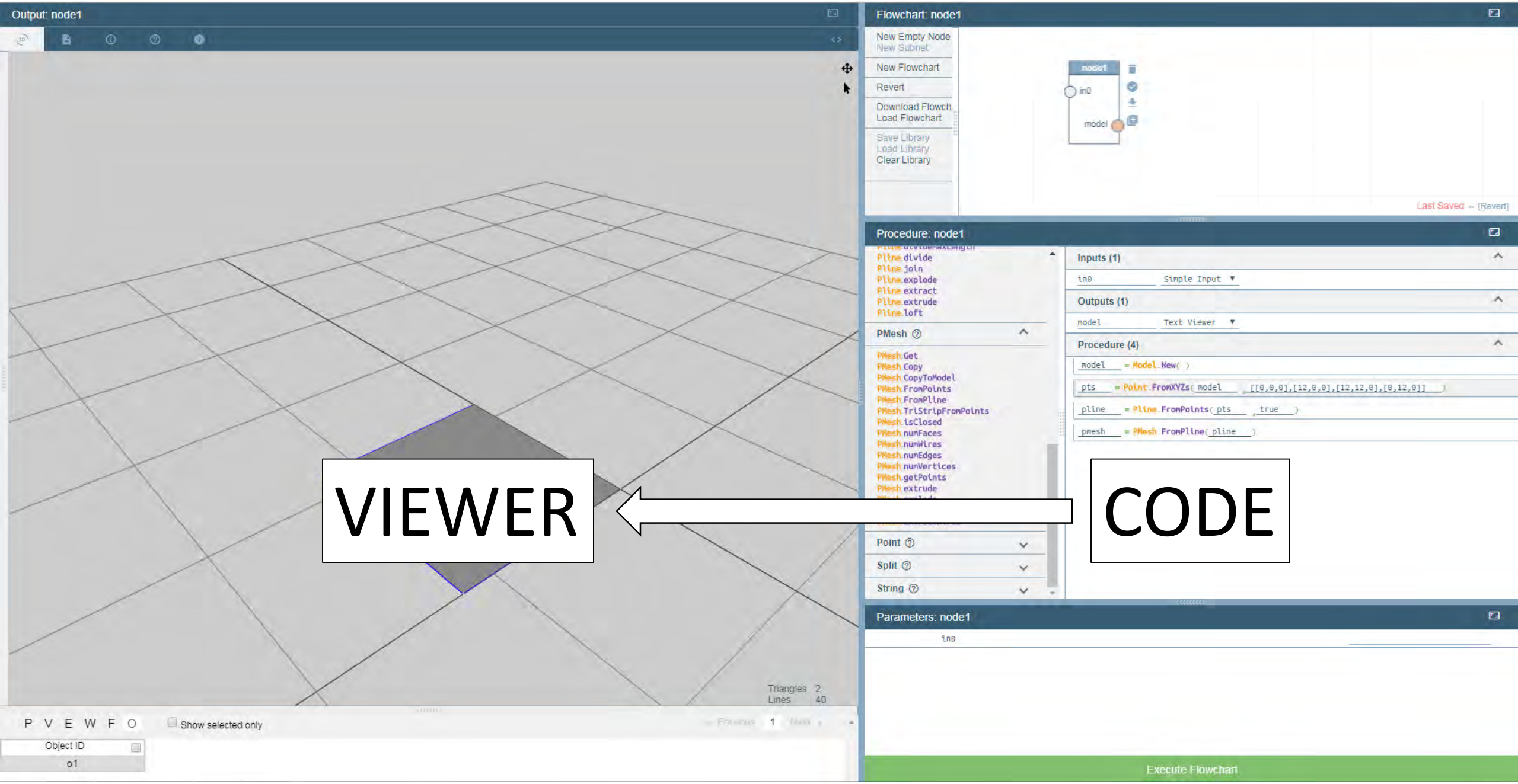
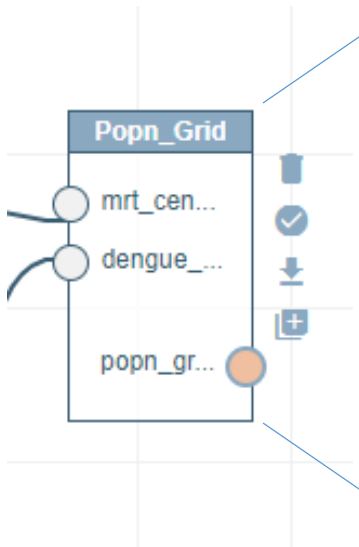

Output: node1
Triangles 2
Lines 40
P V E W F O
Show selected only
Object ID
o1


Flowchart: node1
New Empty Node
New Subnet
New Flowchart
Revert
Download Flowch
Load Flowchart
Save Library
Load Library
Clear Library
node1
in0
model
Last Saved – [Revert]


Procedure: node1
Pline.divide
Pline.join
Pline.explode
Pline.extract
Pline.extrude
Pline.loft
PMesh
PMesh.Get
PMesh.Copy
PMesh.CopyToModel
PMesh.FromPoints
PMesh.FromPline
PMesh.TriStripFromPoints
PMesh.isClosed
PMesh.numFaces
PMesh.numWires
PMesh.numEdges
PMesh.numVertices
PMesh.getPoints
PMesh.extrude
PMesh.explode
PMesh.extractFaces
PMesh.extractWires
Point
Split
String
Inputs (1)
in0
Simple Input
Outputs (1)
model
Text Viewer
Procedure (4)
model = Model.New( )
pts = Point.FromXYZs(model , [[0,0,0],[12,0,0],[12,12,0],[0,12,0]])
pline = Pline.FromPoints(pts , true)
pmesh = PMesh.FromPline(pline)


Parameters: node1
in0
Execute Flowchart


Output: node1
Flowchart: node1
New Empty Node
New Subnet
New Flowchart
Revert
Download Flowch
Load Flowchart
Save Library
Load Library
Clear Library
node1
in0
model
Last Saved – [Revert]
Procedure: node1
Pline.divide
Pline.join
Pline.explode
Pline.extract
Pline.extrude
Pline.loft
PMesh
PMesh.Get
PMesh.Copy
PMesh.CopyToModel
PMesh.FromPoints
PMesh.FromPline
PMesh.TriStripFromPoints
PMesh.IsClosed
PMesh.numFaces
PMesh.numWires
PMesh.numEdges
PMesh.numVertices
PMesh.getPoints
PMesh.extrude
Point
Split
String
Inputs (1)
in0
Simple Input
Outputs (1)
model
Text Viewer
Procedure (4)
model = Model.New( )
pts = Point.FromXYZs(model , [[0,0,0],[12,0,0],[12,12,0],[0,12,0]])
pline = Pline.FromPoints(pts , true)
pmesh = PMesh.FromPline(pline)
VIEWER
CODE
Triangles 2
Lines 40
P V E W F O
Show selected only
Previous 1 Next
Object ID
o1
Parameters: node1
in0
Execute Flowchart




```
mrt_centroids      Simple Input
dengue_hotspots    Simple Input
sg_grid            File

Outputs (1)

popn_grid          Text Viewer

Procedure (12)

features = geo.convert.flatten( popn )
features = features.features
grid_features = sg_grid.features
grid_centroid = []
dist_list = []
for each ( g in grid_features )
    g_centroid = geo.calc.centroid( g , undefined )
    grid_centroid = arr.modify.append( grid_centroid , g_centroid )
    mrt_min_dist = Infinity
    den_min_dist = 0
    weight = 0
    sum = 0
    sum = math.stats.sum( dist_list )
    for each ( d in dengue_hotspots )
    if-else
        if( sum>0 )
            den_min_dist = weight*sum
        else
    for each ( c in mrt_centroids )
        dist = geo.calc.distance( c , g_centroid , undefined )
        if-else
            if( dist<mrt_min_dist )
                mrt_min_dist = dist
            else
    set = geo.prop.setValue( g , "mrt_dist" , mrt_min_dist )
    set = geo.prop.setValue( g , "dengue_dist" , den_min_dist )
```

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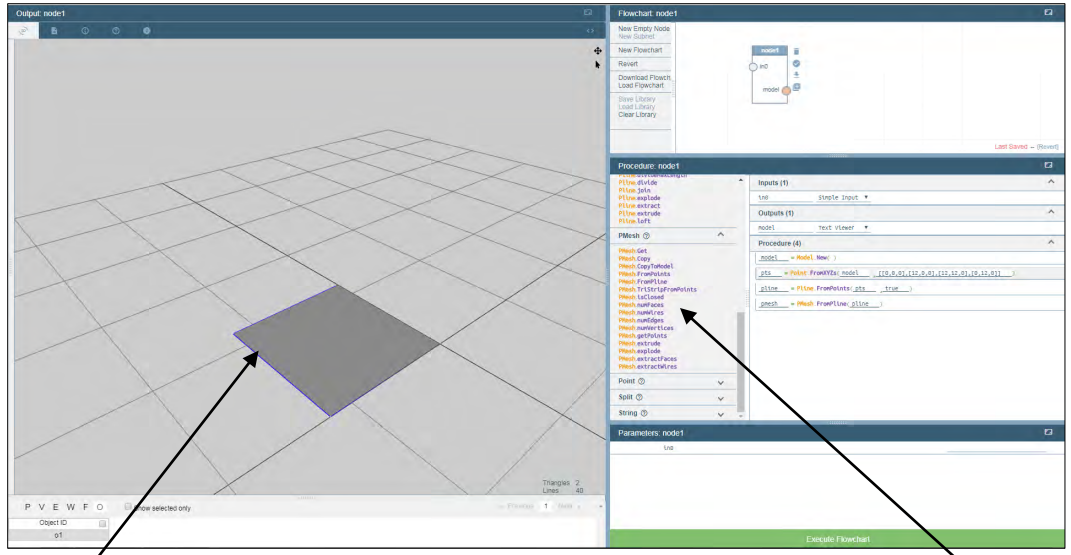
Möbius Parametric Modeller



gs-viewer

gs-json

gs-modelling

gs: geometry + semantics

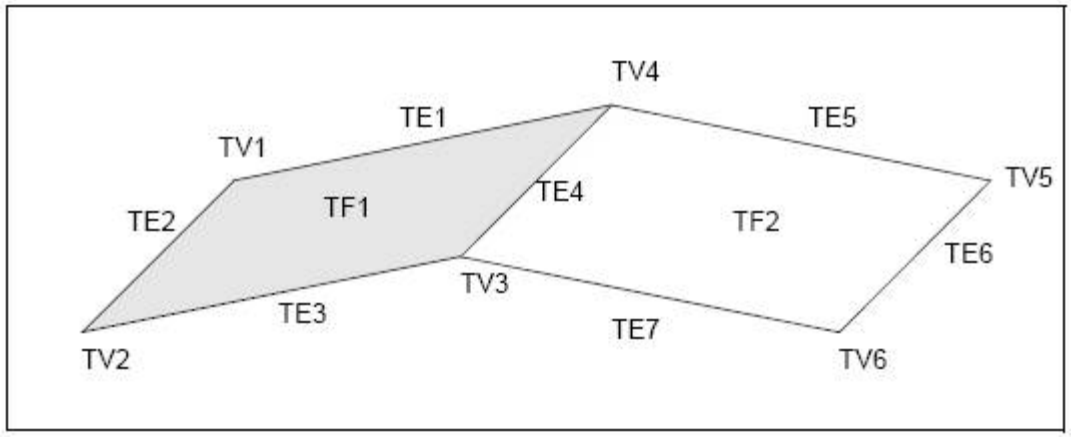
Topological Modelling

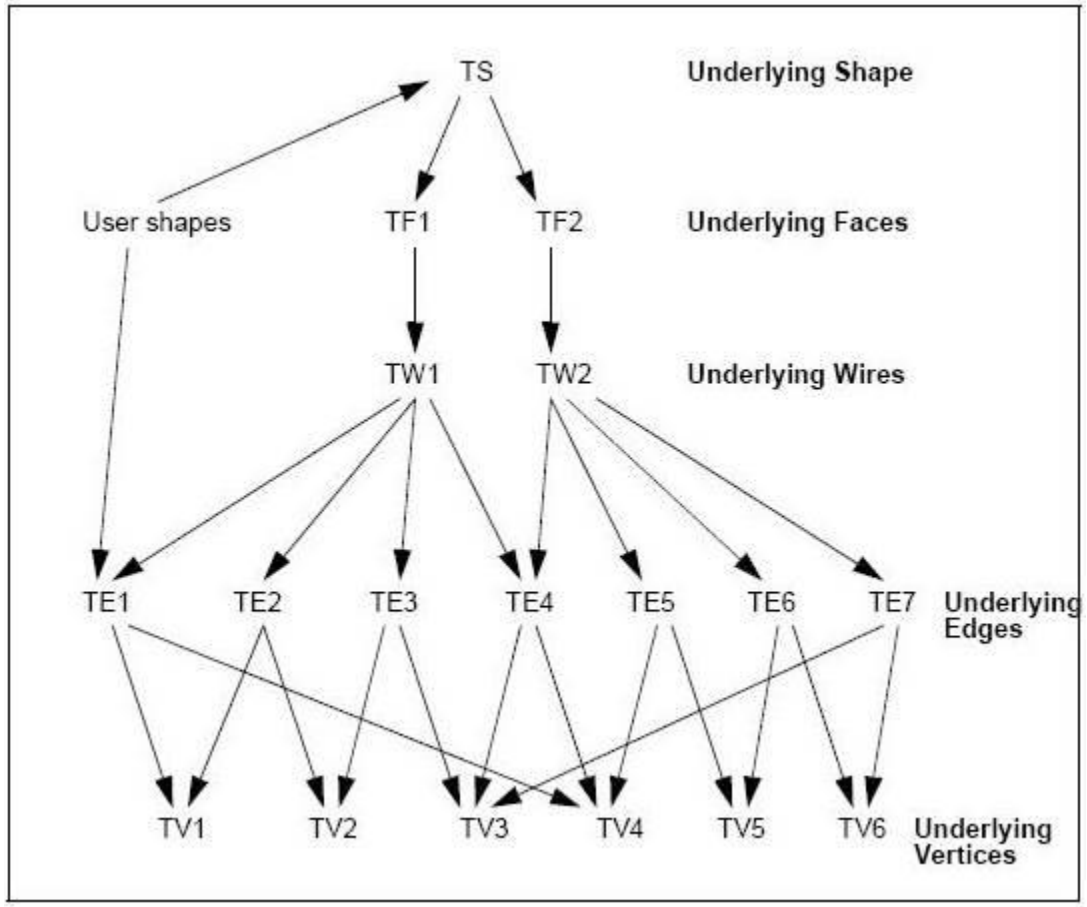
- Example: OpenCascade

  A topological model can be considered as a graph of objects with adjacency relationships.

- In GIS?

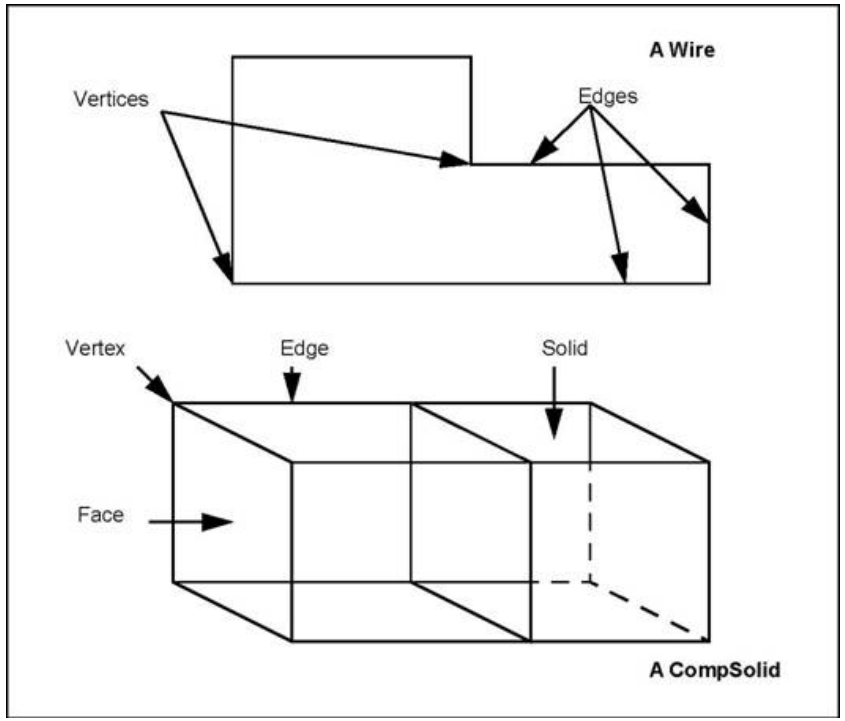
http://planet.botany.uwc.ac.za/nisl/gis/gis_primer/page_22.htm





Topological Modelling

- OpenCascade



Topological types
TopAbs contains the *TopAbs_ShapeEnum* enumeration,which lists the different topological types:

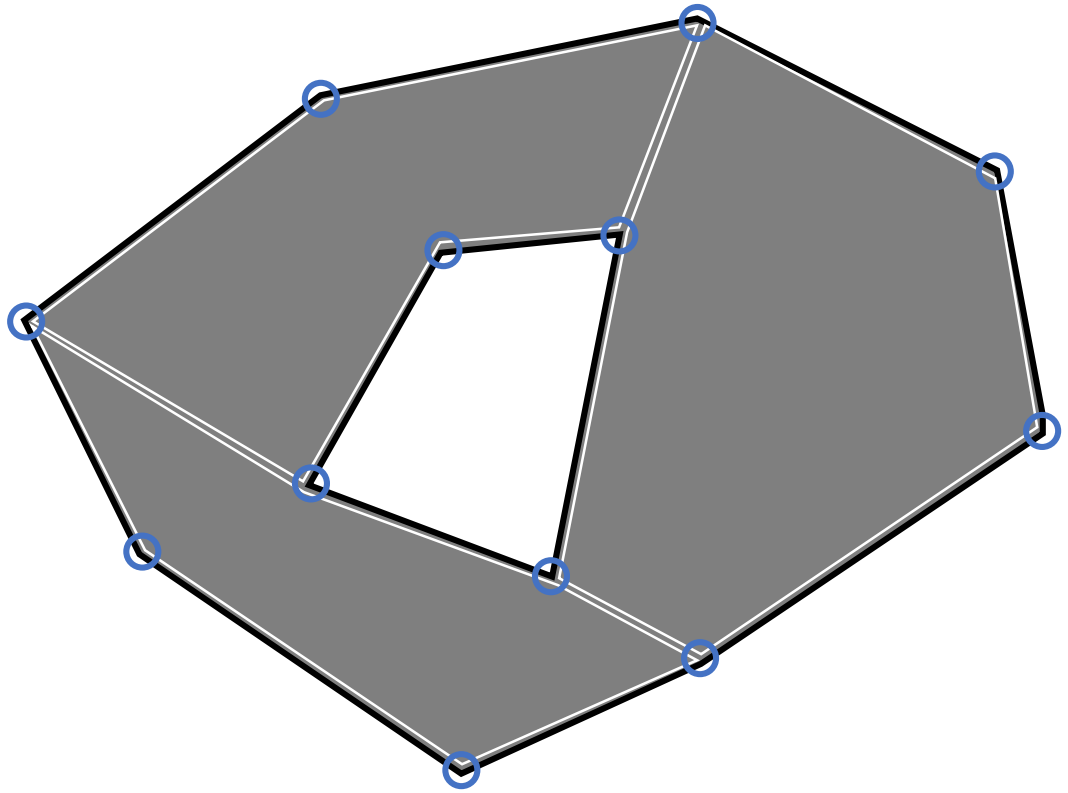
- COMPOUND – a group of any type of topological objects.
- COMPSOLID – a composite solid is a set of solids connected by their faces. It expands the notions of WIRE and SHELL to solids.

- **SOLID** – a part of space limited by shells. It is three dimensional.
- **SHELL** – a set of faces connected by their edges. A shell can be open or closed.
- **FACE** – in 2D it is a part of a plane; in 3D it is a part of a surface. Its geometry is constrained (trimmed) by contours. It is two dimensional.
- **WIRE** – a set of edges connected by their vertices. It can be an open or closed contour depending on whether the edges are linked or not.
- **EDGE** – a topological element corresponding to a restrained curve. An edge is generally limited by vertices. It has one dimension.
- **VERTEX** – a topological element corresponding to a point. It has zero dimension.

https://www.opencascade.com/doc/occt-7.0.0/overview/html/occt_user_guides__modeling_data.html

Topological Modelling

- gs-json
- Example: a polymesh



Topological types

Geometric objects have four topological component levels:

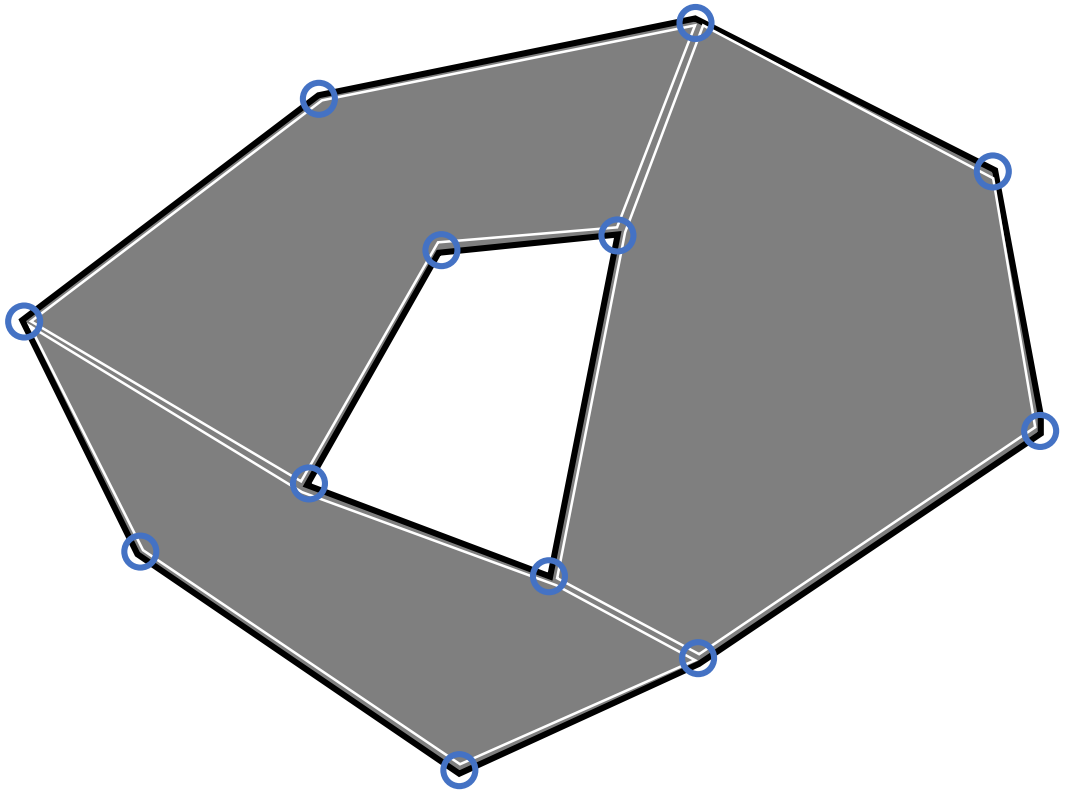
- **FACE** – in 2D it is a part of a plane; in 3D it is a part of a surface. Its geometry is constrained (trimmed) by contours. ~~It is two dimensional.~~
- **WIRE** – a set of ***naked*** edges connected by their vertices. It can be an open or closed contour depending on whether the edges are linked or not.
- **EDGE** – a topological element corresponding to a restrained curve. An edge is generally limited by vertices. It has one dimension.
- **VERTEX** – a topological element corresponding to a point. It has zero dimension.

GROUP

- Groups can contain any of the above topological components.

Topological Modelling

- gs-json
- Example: a polymesh



Attributes

- Attributes are key-value pairs that can be attached to an object or a topo inside an object

- **OBJECT** attributes
- **TOPO** attributes
  - **FACE** attributes
  - **WIRE** attributes
  - **EDGE** attributes
  - **VERTEX** attributes

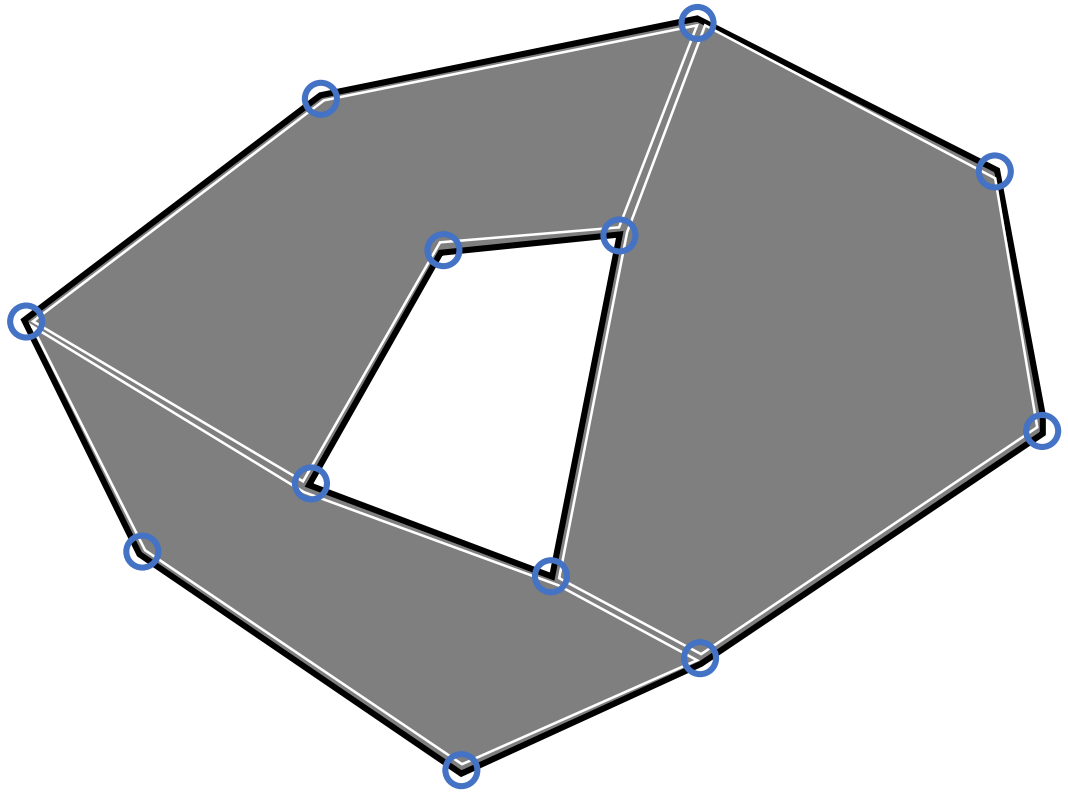
Properties

- Properties are key-value pairs that can be attached to a group.

- **GROUP** properties.

Topological Modelling

- gs-json
- Example: a polymesh

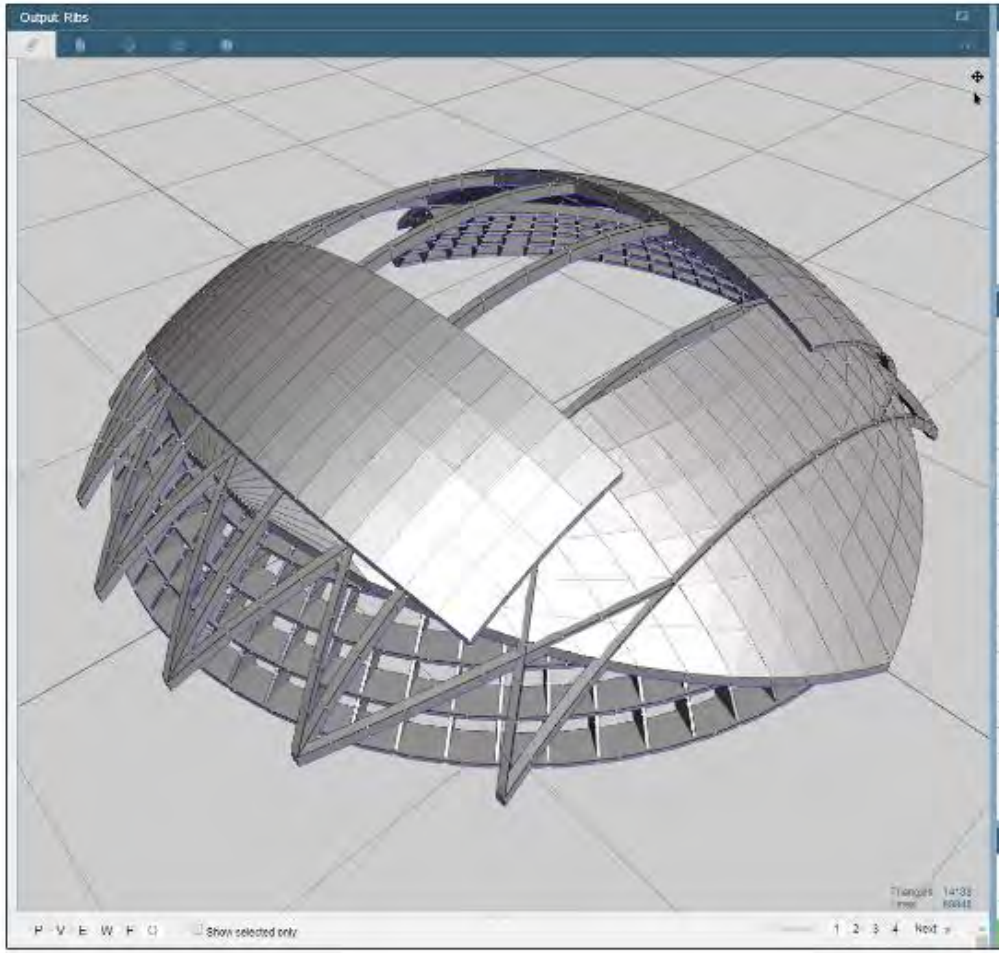


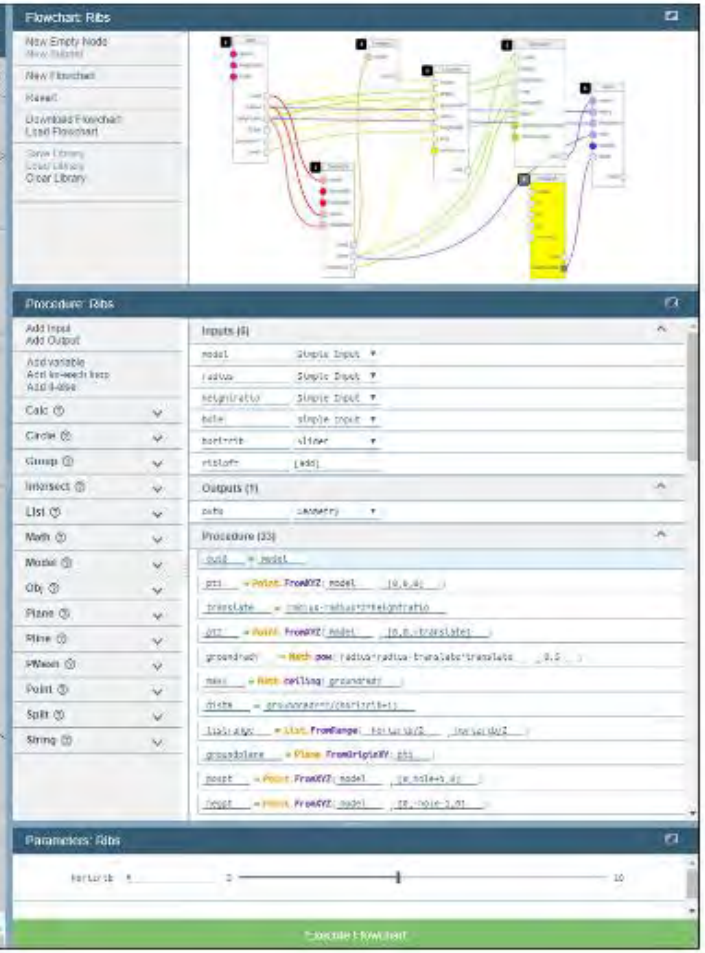
JSON Representation

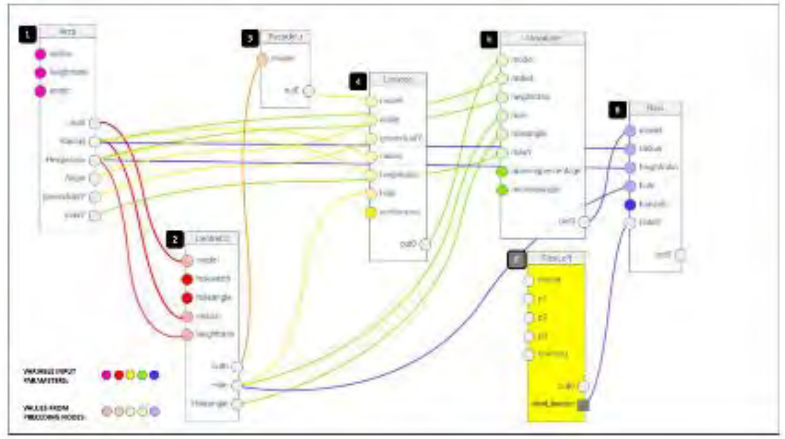
- In order to keep the representation efficient, edges are only represented implicitly.

Polygon mesh:

```
[
    [
        [60,61,62,63,64,65,66,67,68,-1],    // outer wire
        [10,11,12,13,-1]]                   // inner wire
    [
        [60,61,62,12,11,10,-1],             // face 1
        [62,63,64,65,13,12,-1],             // face 2
        [65,66,67,68,10,13,-1]]             // face 3
    [200]
]
```

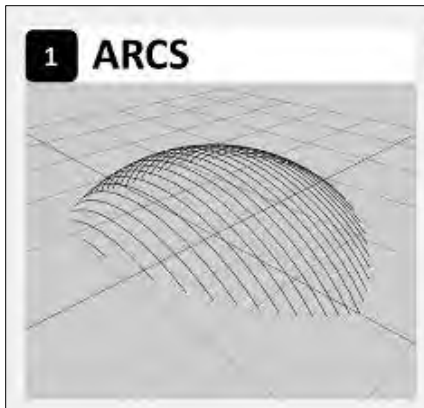


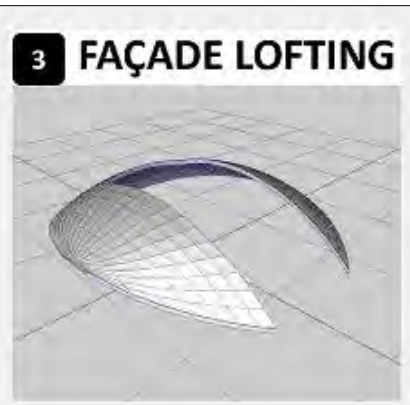


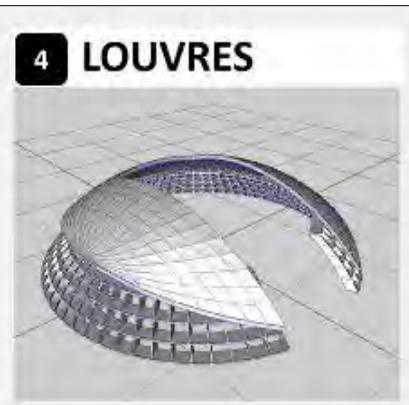


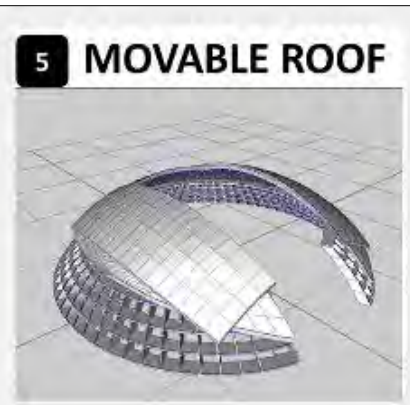
Procedure (33)

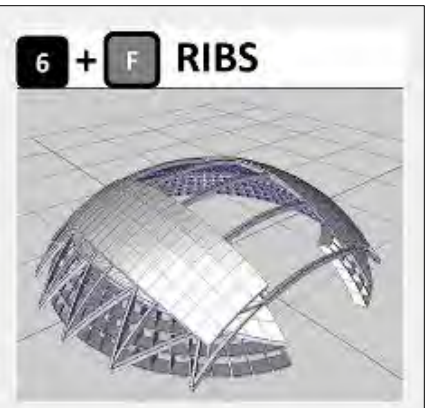
```
out0 = model
pt1 = Point.FromXYZ( model , [0,0,0] )
translate = radius-radius*2*heightratio
pt2 = Point.FromXYZ( model , [0,0,-translate] )
groundradV = Math.pow( radius*radius-translate*translate , 0.5 )
maxV = Math.ceiling( groundradV )
distB = groundradV*2/(horizrib+1)
listrange = List.FromRange( -horizrib/2 , horizrib/2 )
groundplane = Plane.FromOriginXY( pt1 )
pospt = Point.FromXYZ( model , [0,hole+1,0] )
negpt = Point.FromXYZ( model , [0,-hole-1,0] )
```

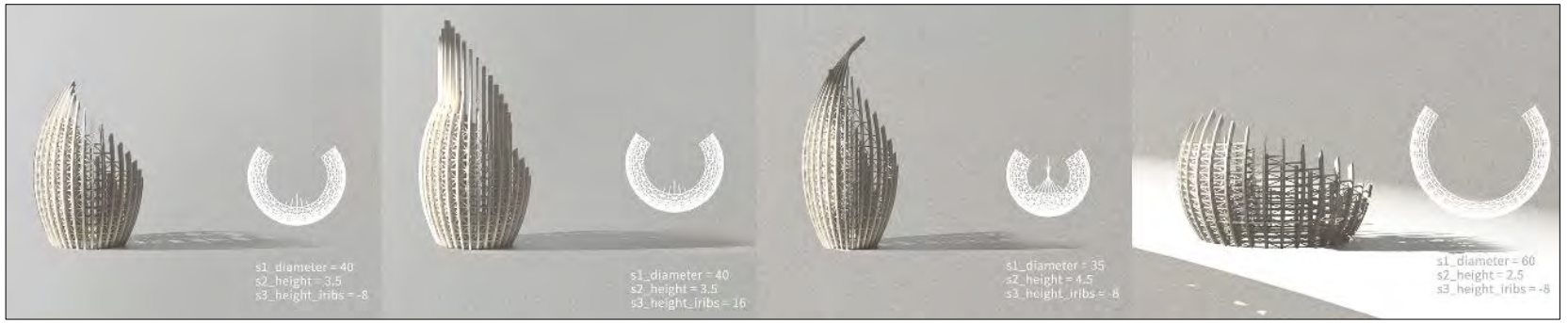


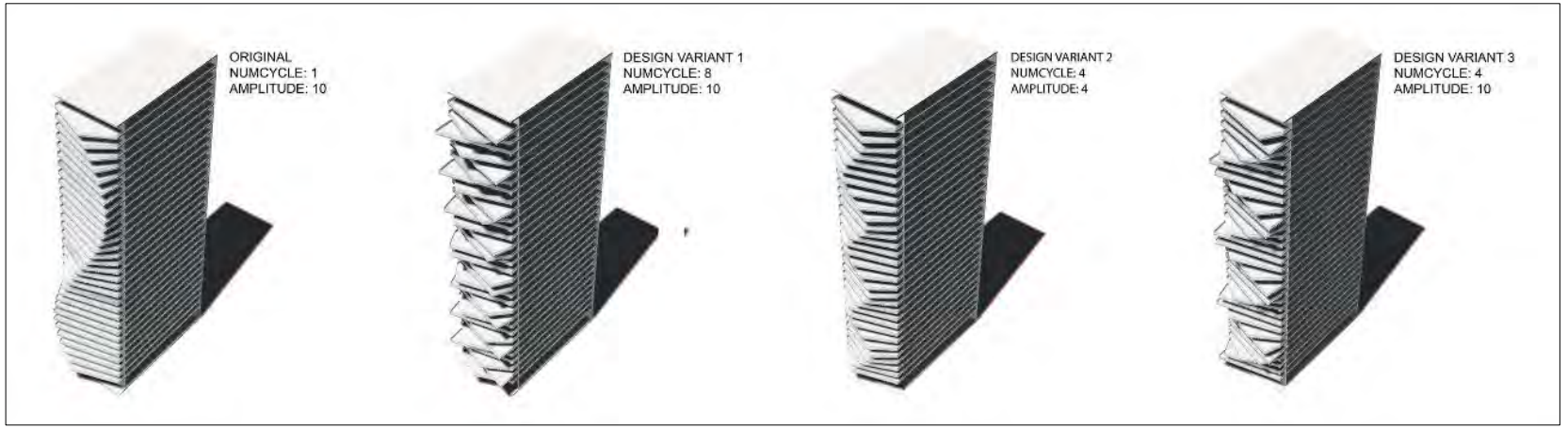


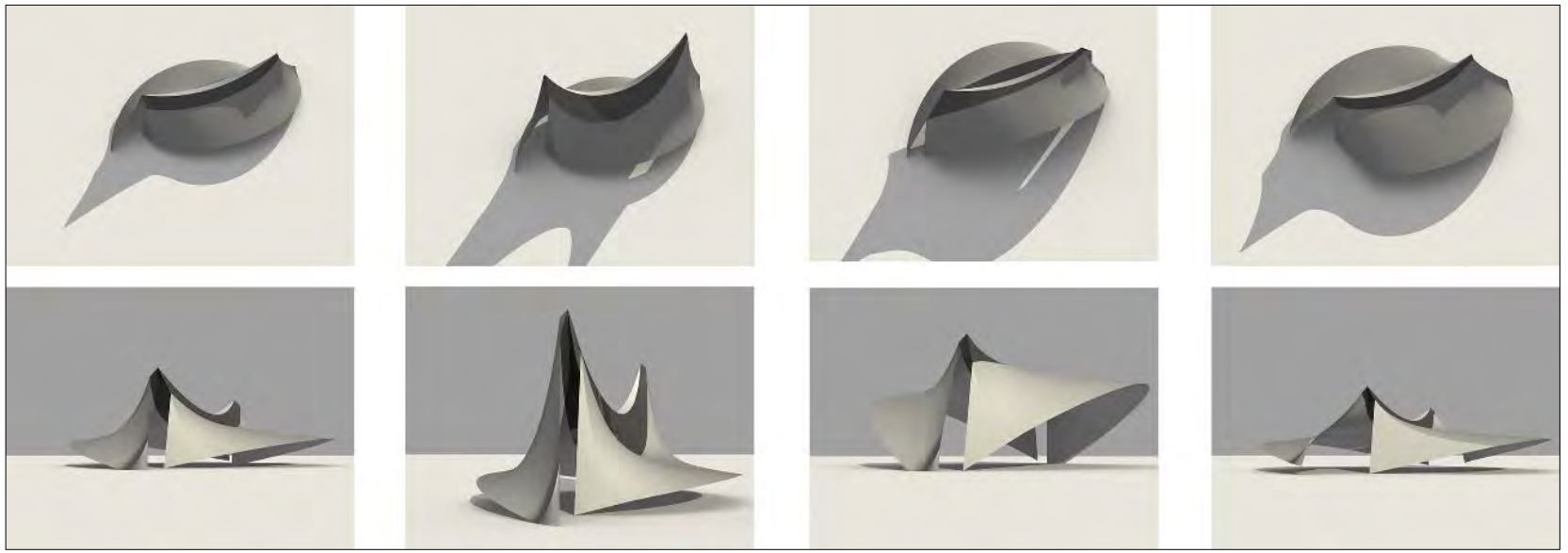







s1_diameter = 40
s2_height = 3.5
s3_height_iribs = -8
s1_diameter = 40
s2_height = 3.5
s3_height_iribs = 16
s1_diameter = 35
s2_height = 4.5
s3_height_iribs = -8
s1_diameter = 60
s2_height = 2.5
s3_height_iribs = -8


ORIGINAL
NUMCYCLE: 1
AMPLITUDE: 10
DESIGN VARIANT 1
NUMCYCLE: 8
AMPLITUDE: 10
DESIGN VARIANT 2
NUMCYCLE: 4
AMPLITUDE: 4
DESIGN VARIANT 3
NUMCYCLE: 4
AMPLITUDE: 10



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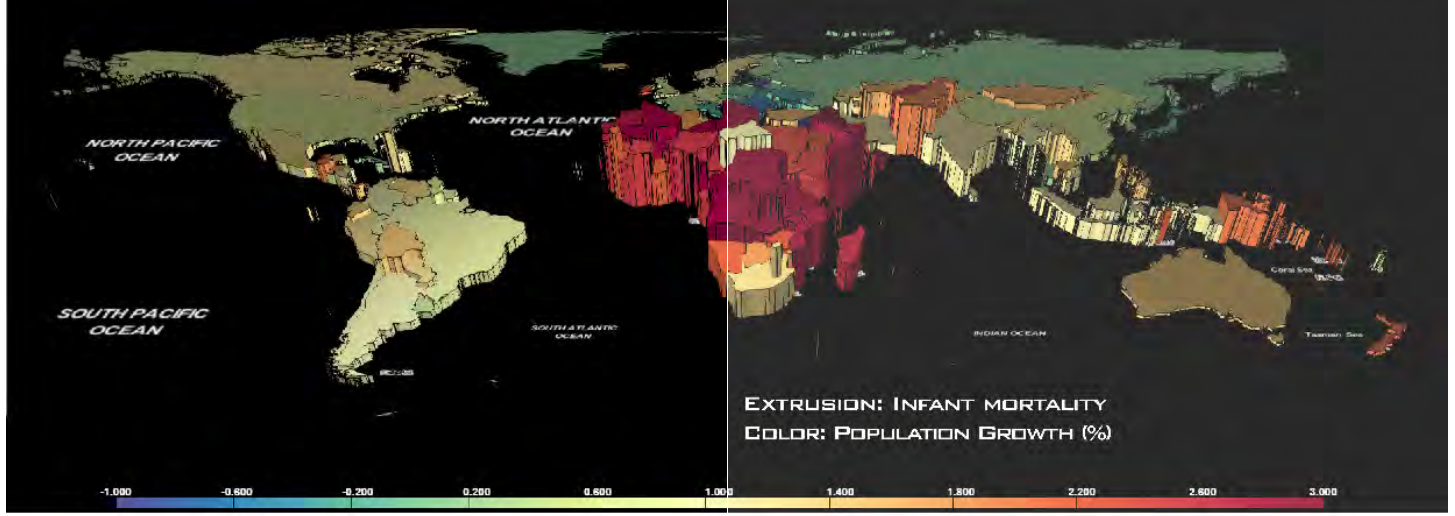
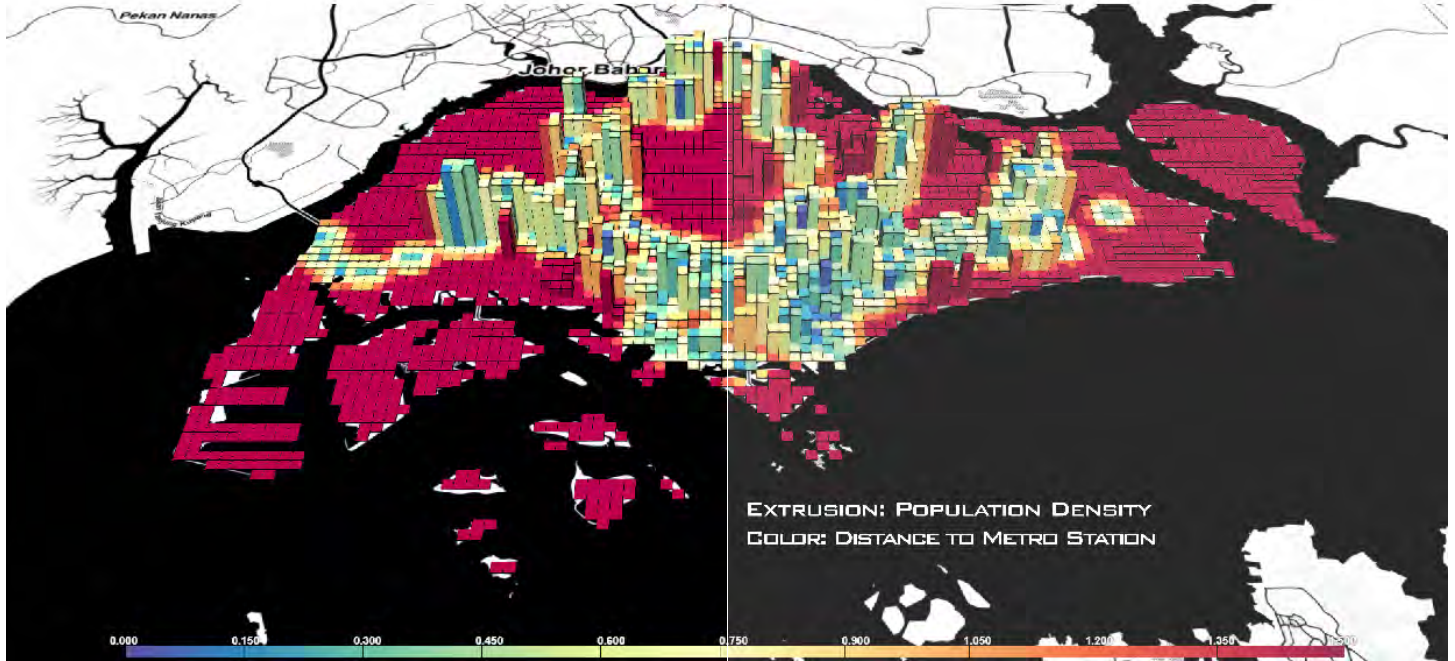


EXTRUDED CITIES

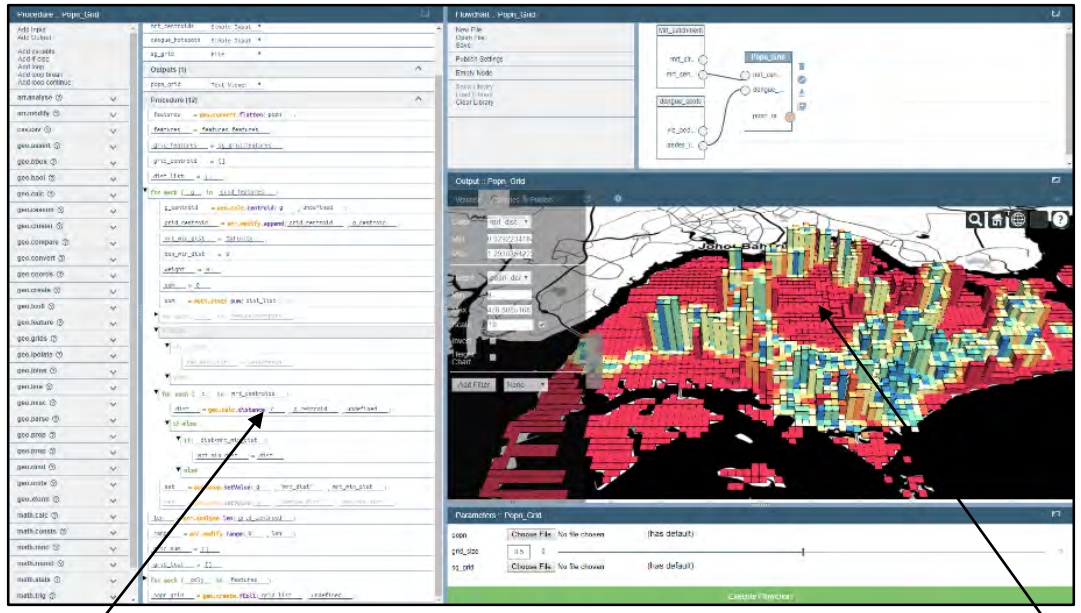
CAADRIA '18 WORKSHOP 02

Lead: Assoc Prof Patrick Janssen
Design Automation Lab, National University of Singapore
In collaboration with: Assoc Prof.龙瀛 Ying Long
Beijing City Lab, Tsinghua University.
Assistants: Chen Kien Wee, Akshata Mohanty, Sun Huiyao, Likai Wang, Joic Lim, Derek Pung, Wenting Hsu

BINGJUN XU | BAYI LI | HUI LIAO | LI YANG | LUYAO HOU | WENHAN FENG | WU SHUYUN | XINRUI ZHANG | XINTIAN LI
PENGYU WANG | SHANG LIU | ZEKUN FAN | ZIDONG HUANG | ZIXIAO TANG



Möbius Geospatial Modeller



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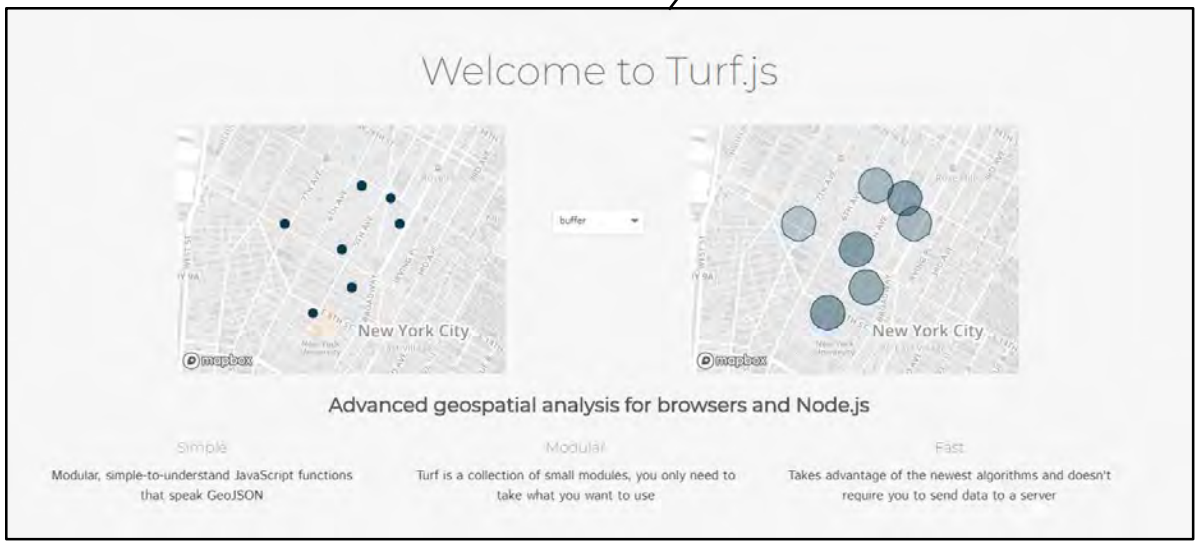
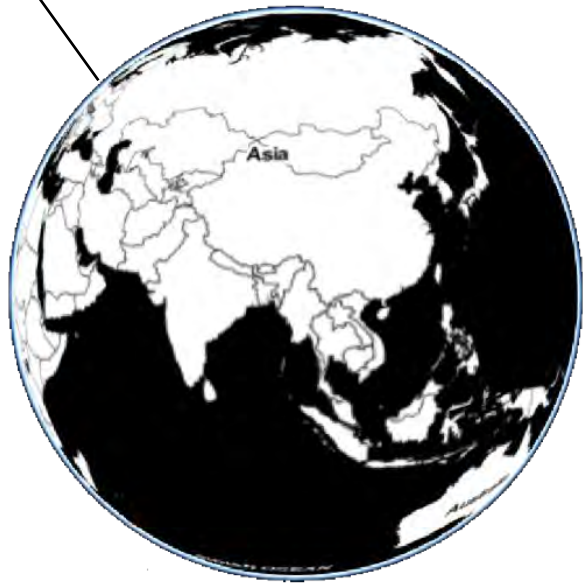


CESIUMJS.COM



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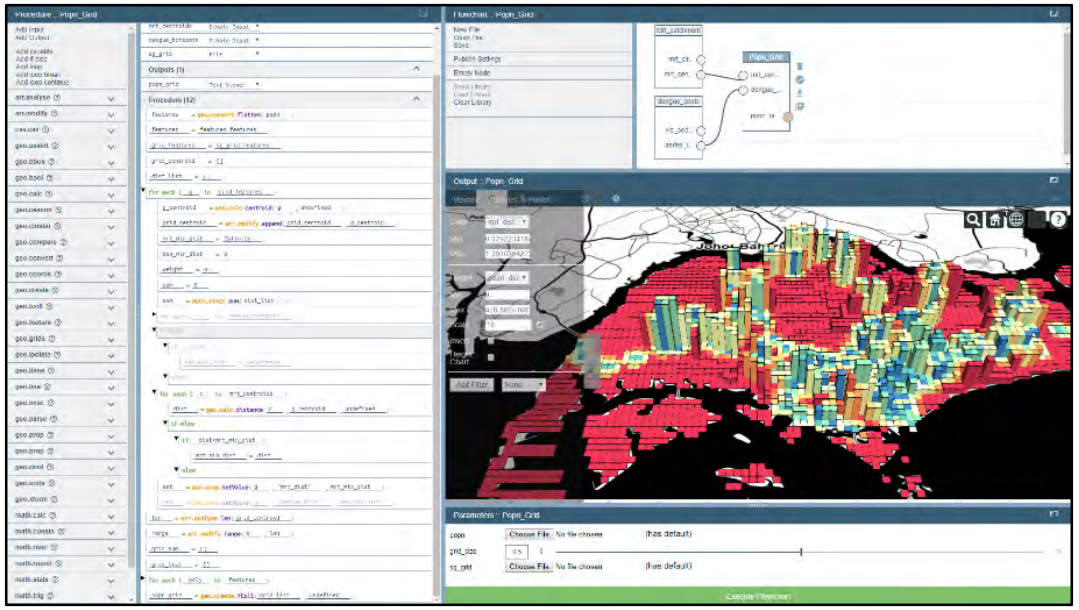
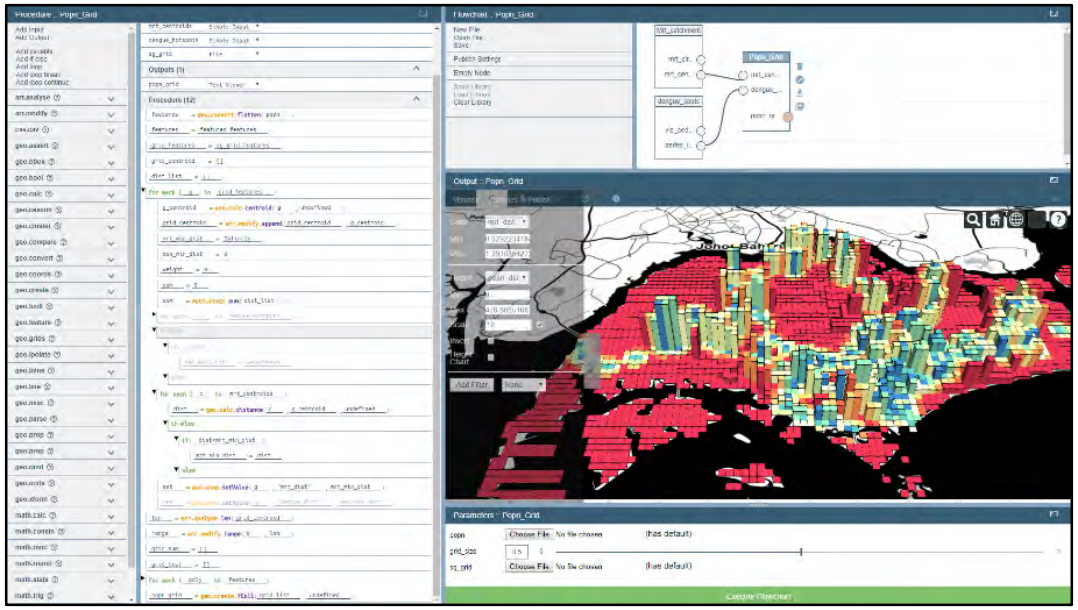
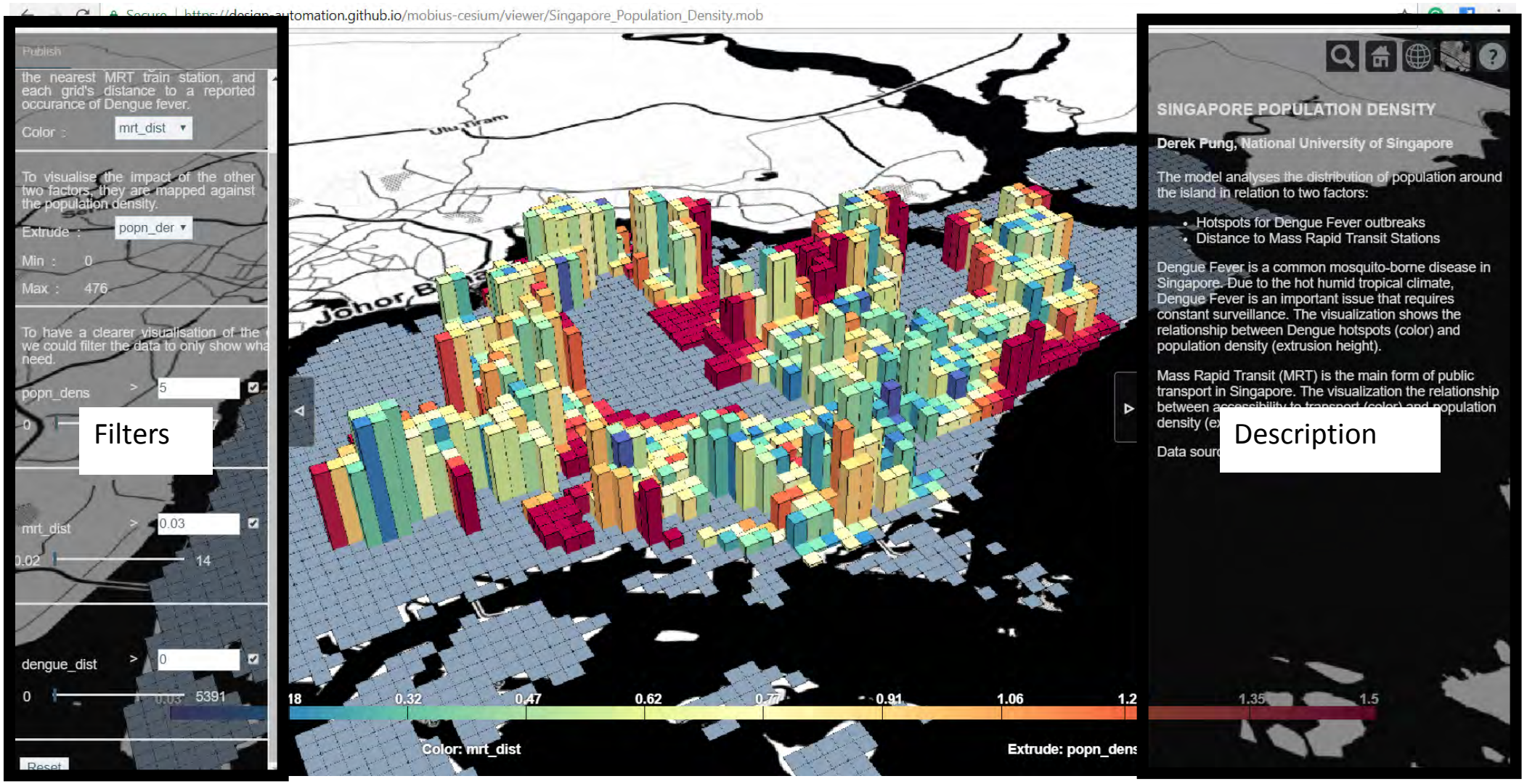


BIG DATA MUST BECOME **SMALL DATA**

Möbius Geospatial Modeller



QGIS



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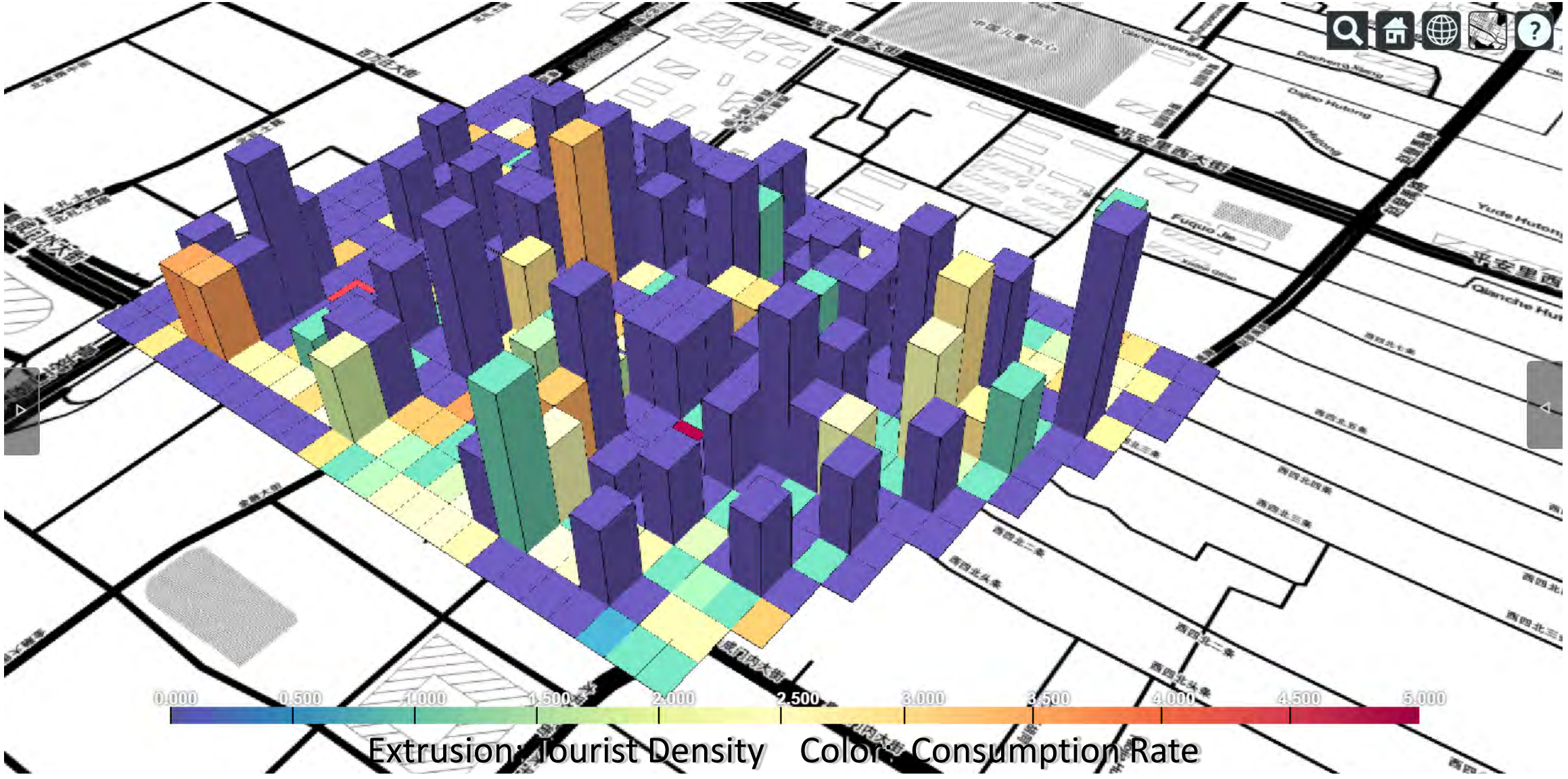
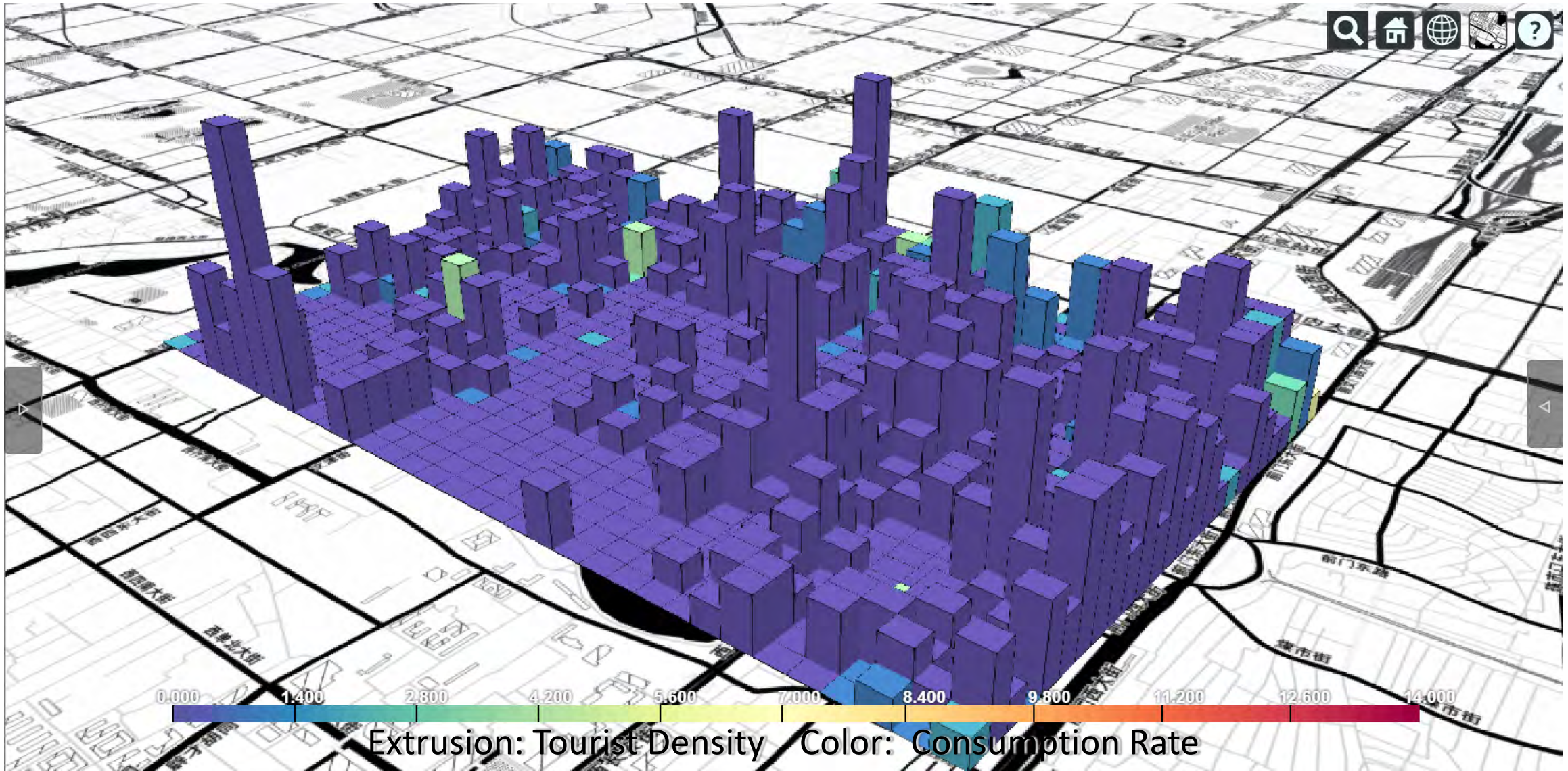
Extrude Baita Temple

Bayi Li, Shanghai University; Wenhan Feng, Shandong University of Science and Technology



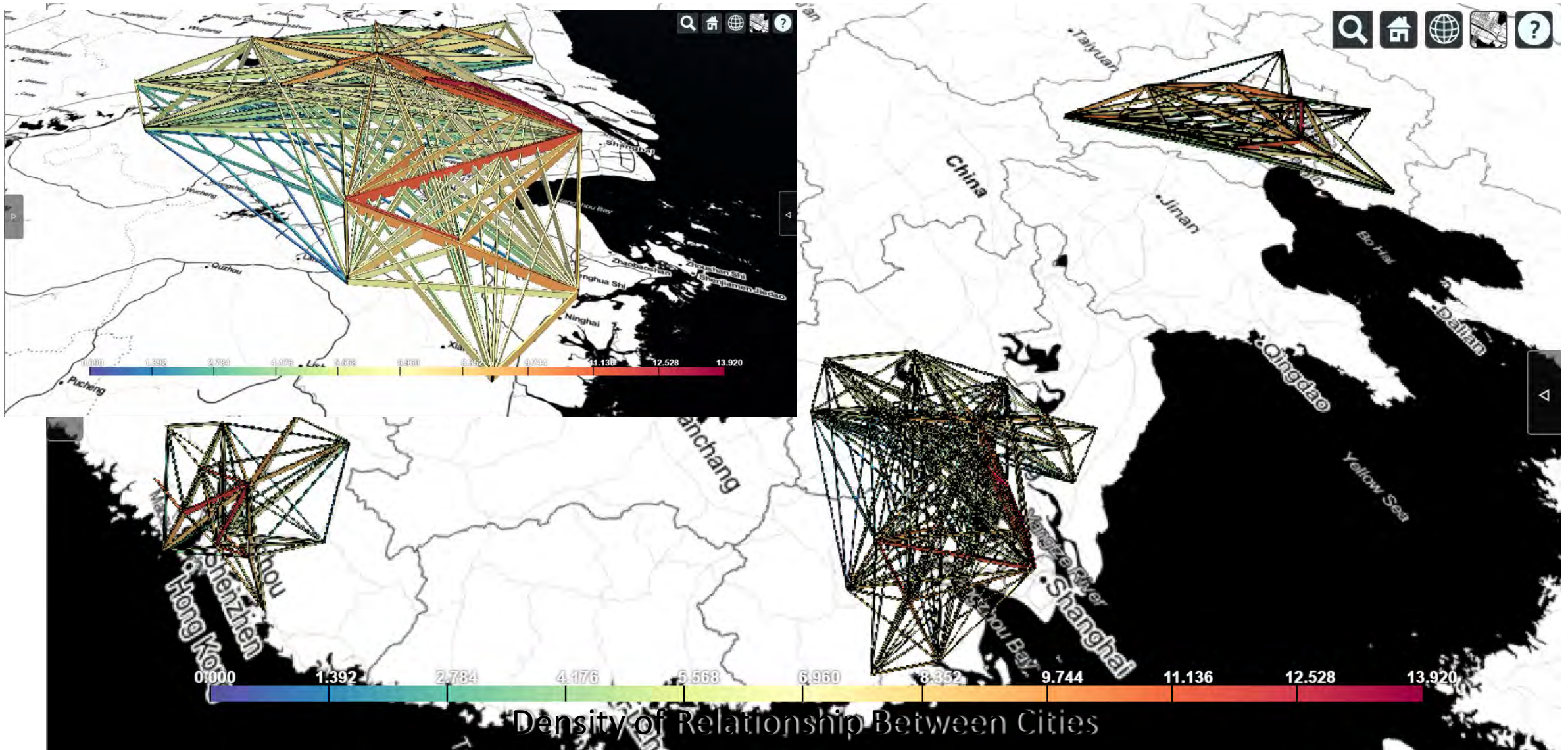
Extrude Forbidden City

Bayi Li, Shanghai University; Wenhan Feng, Shandong University of Science and Technology



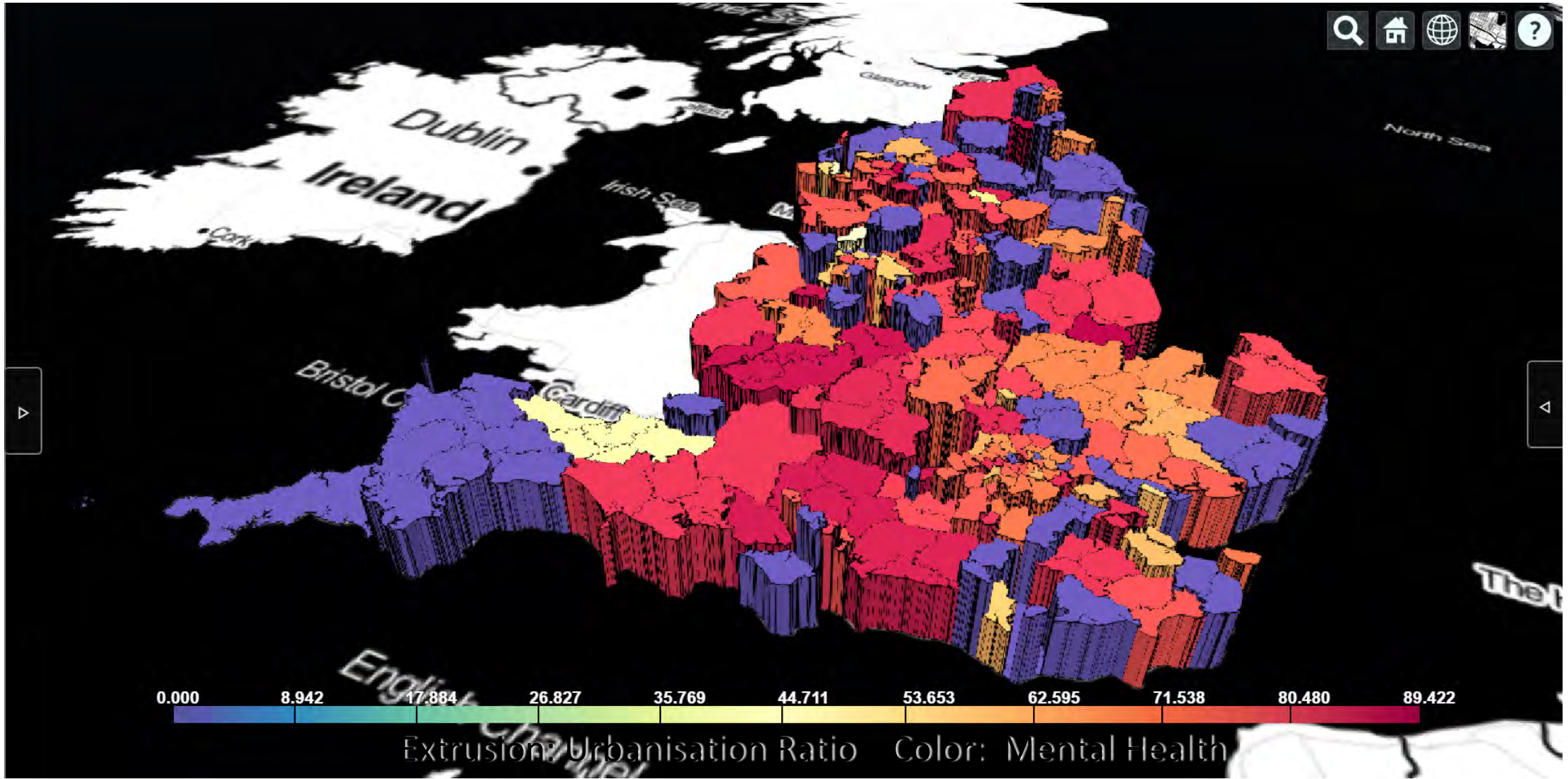
Density of Metropolitan Regions

Zixiao Tang, Peking University, Bingjun Xu, Tsinghua University



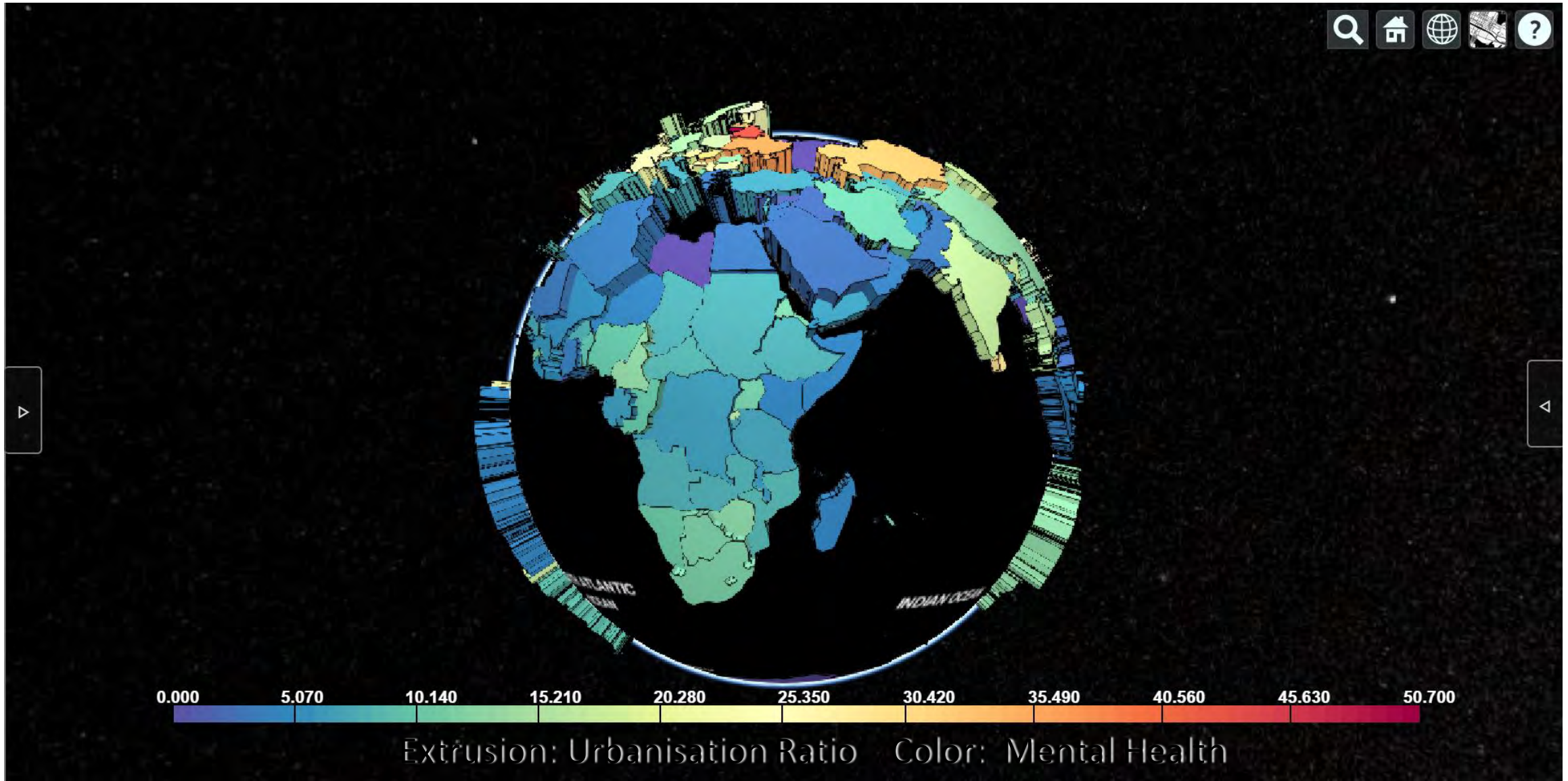
Between Mental Health and Urbanisation

Liu jiangde, Tongji University



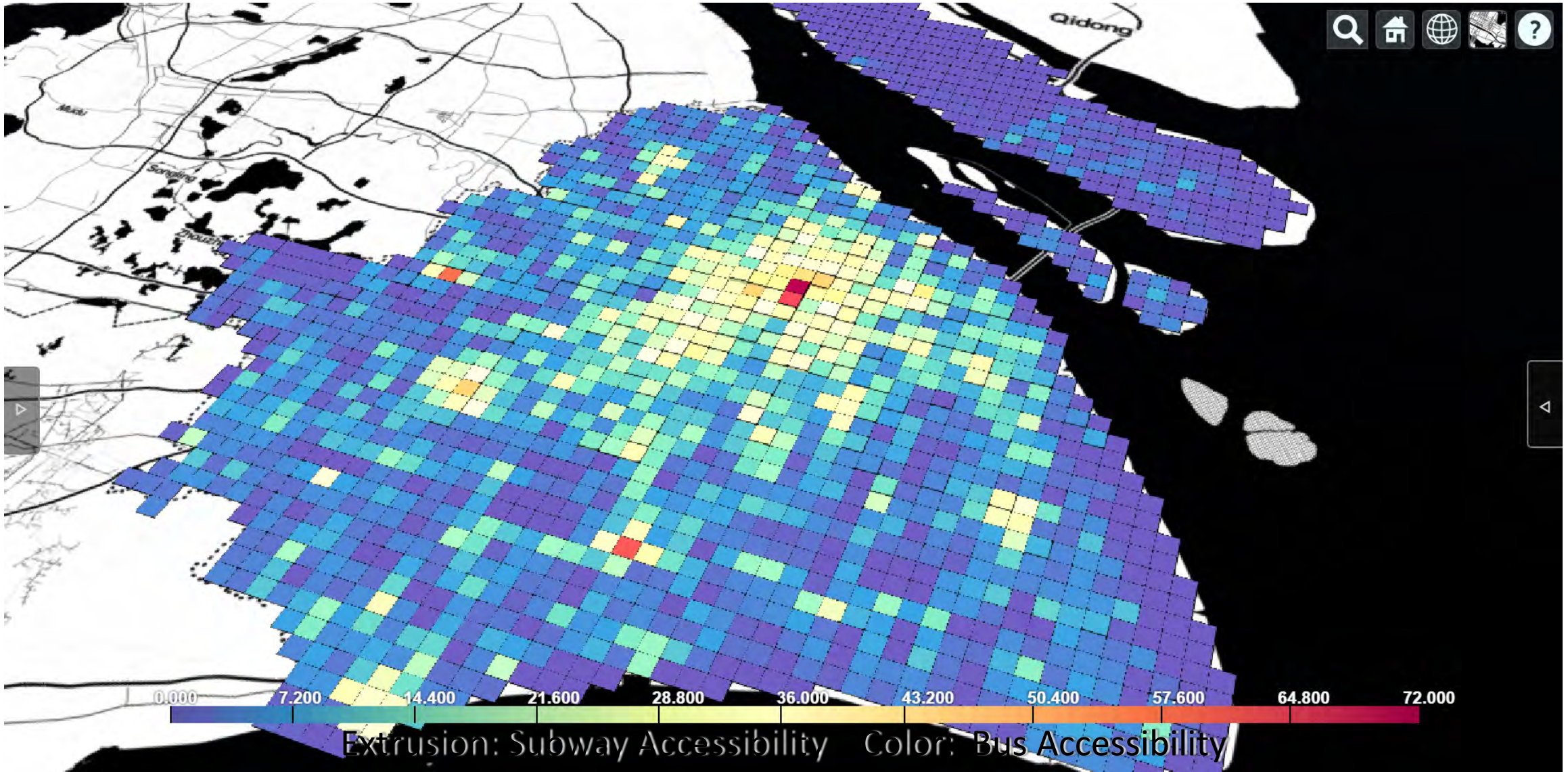
Between Mental Health and Urbanisation

Liu jiangde, Tongji University



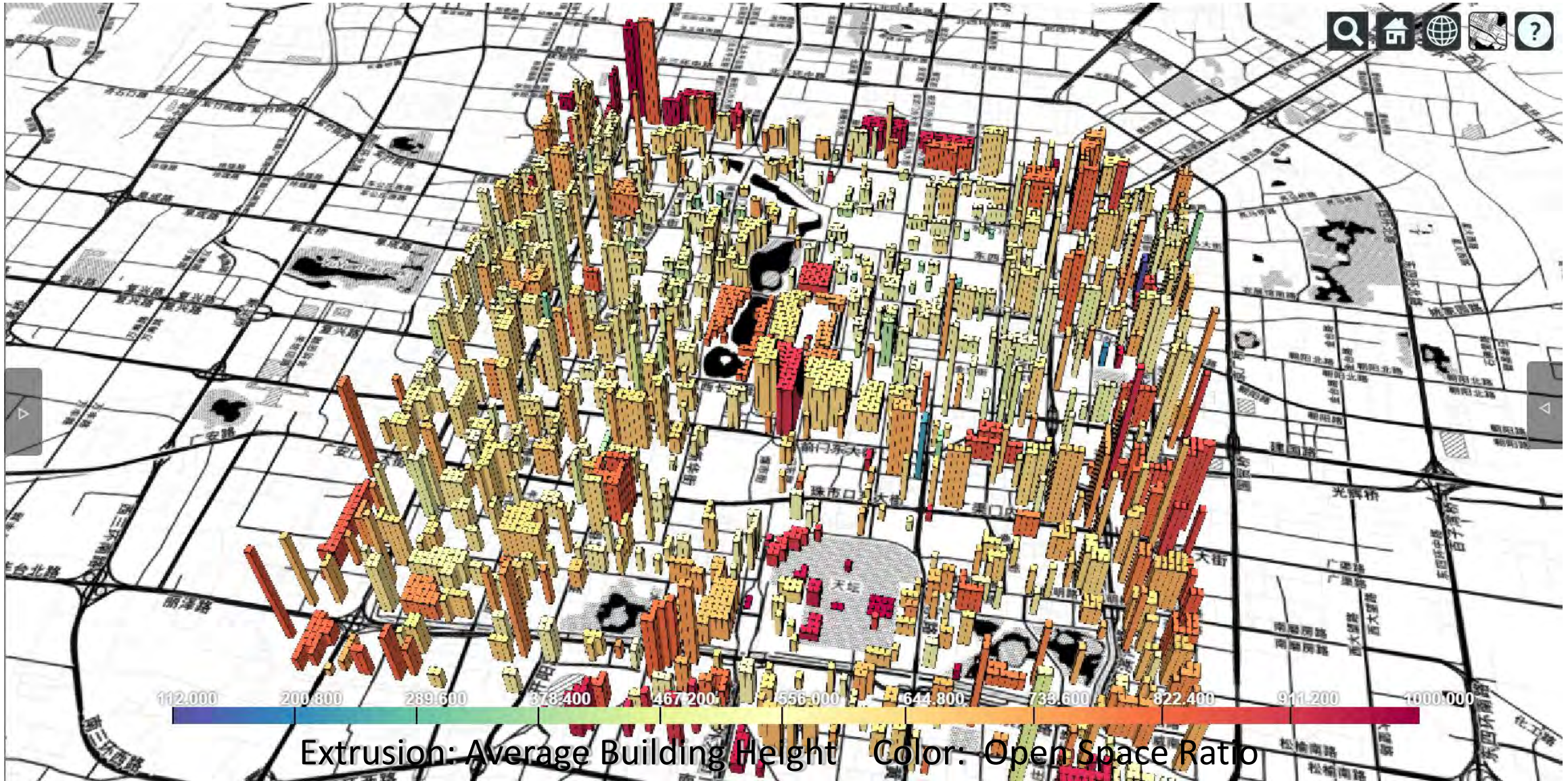
Shanghai Transportation Distribution

Luyao Hou, Smith College



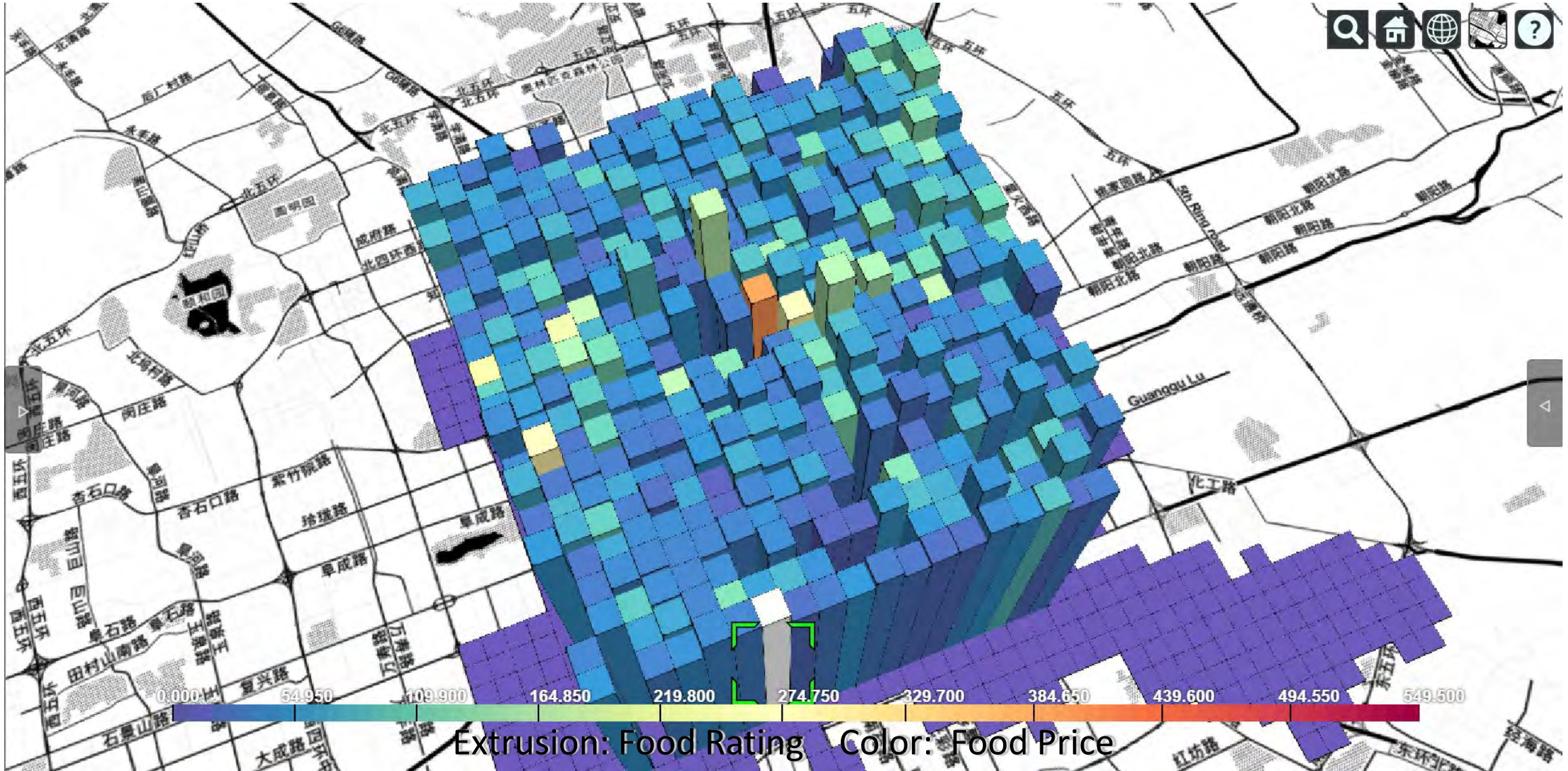
Social Space Filter

Li Yang, The University of Sydney



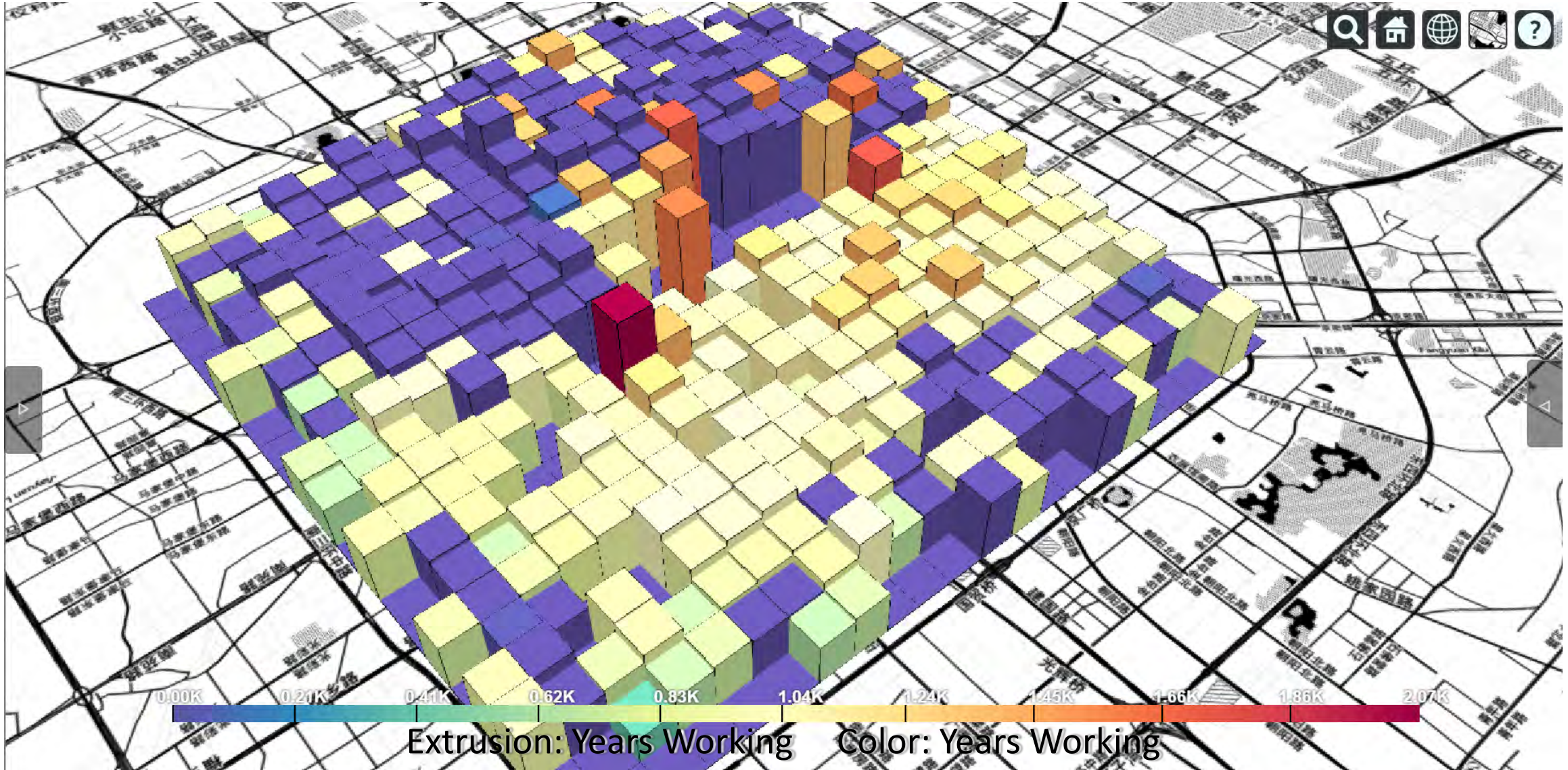
The Food Map of Beijing Old City

Pengyu Wang,Xiamne University



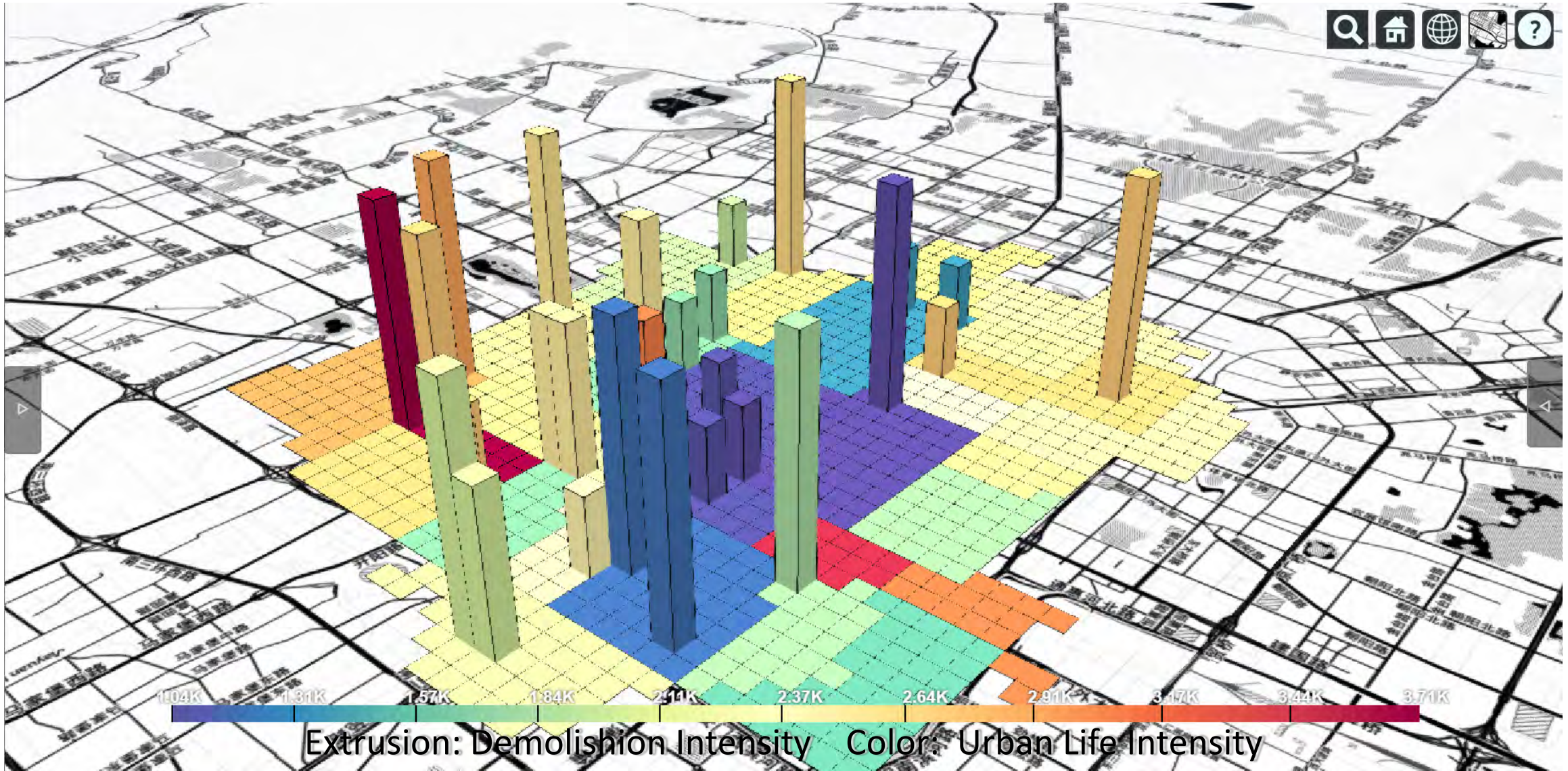
Where Shall the Architects Live

Xinrui Zhang 张欣瑞, Central Academy of Fine Arts



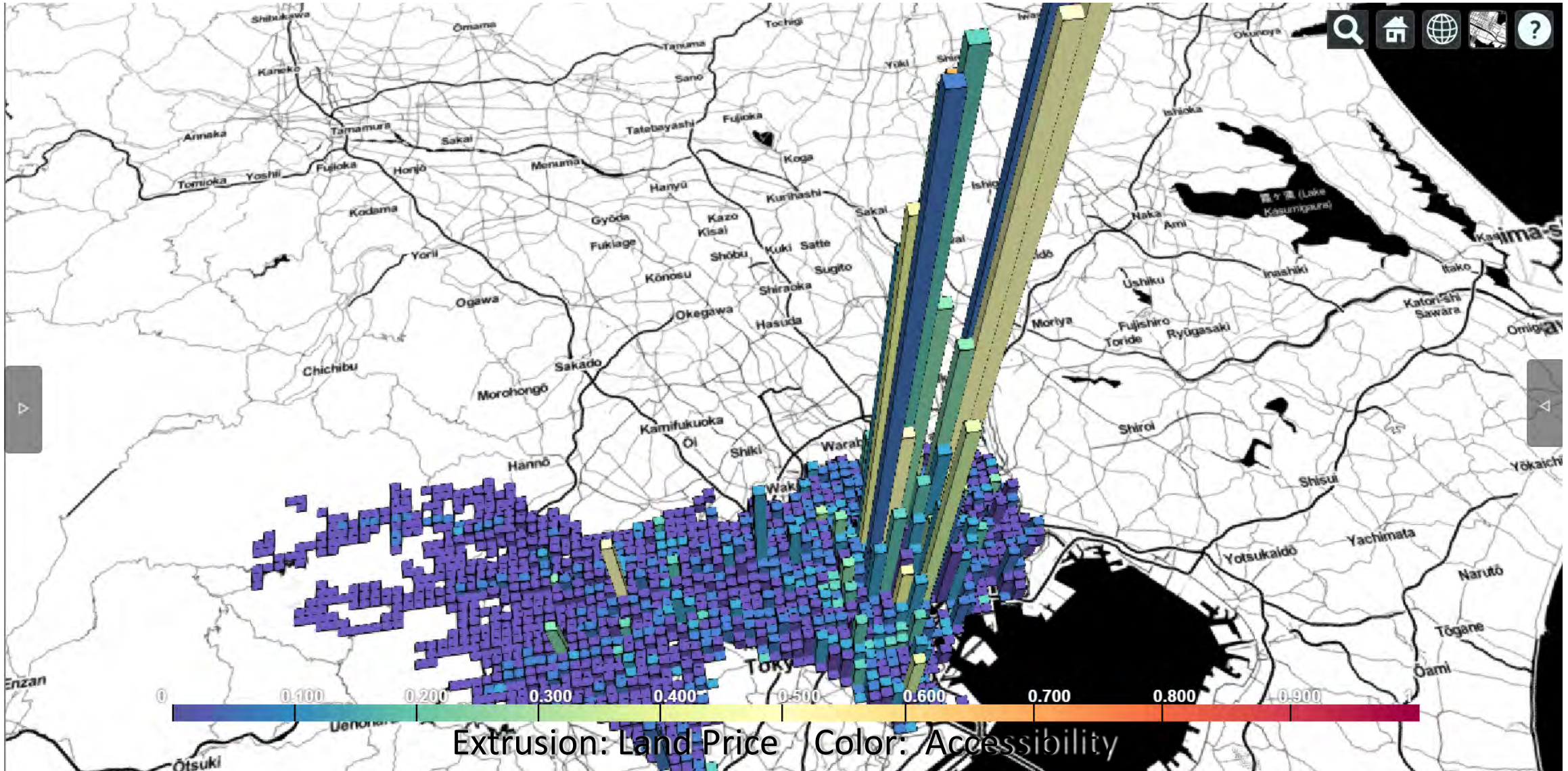
Impacts of Demolitions on Urban Life

Zidong Huang, Peking University



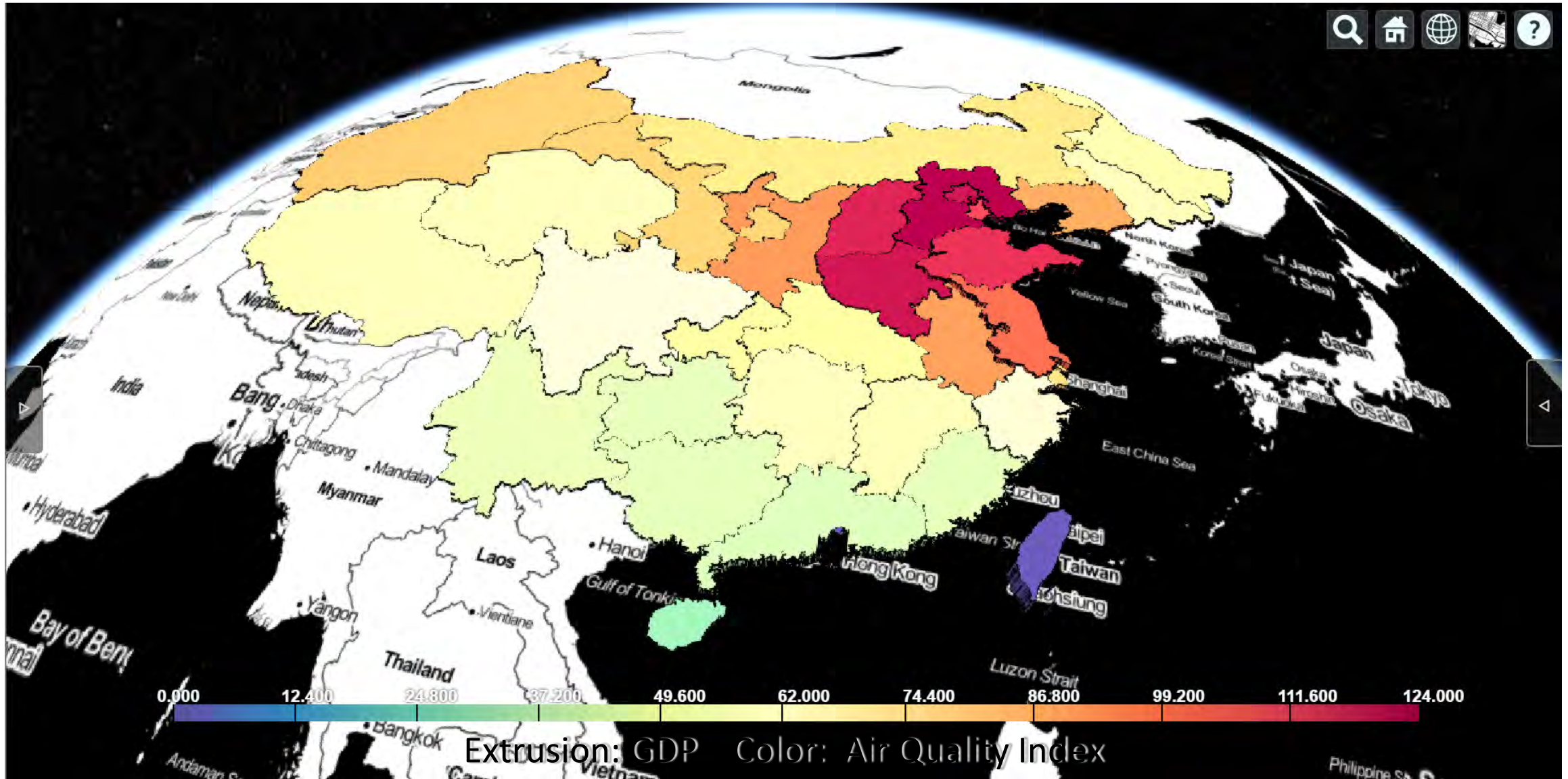
Tokyo Land Price: Population and Accessibility

Shuyun Wu, Southeast University, Hui Liao, Shandong University of Science and Technology



Urbanization in China

Xintian Li, Southeast University



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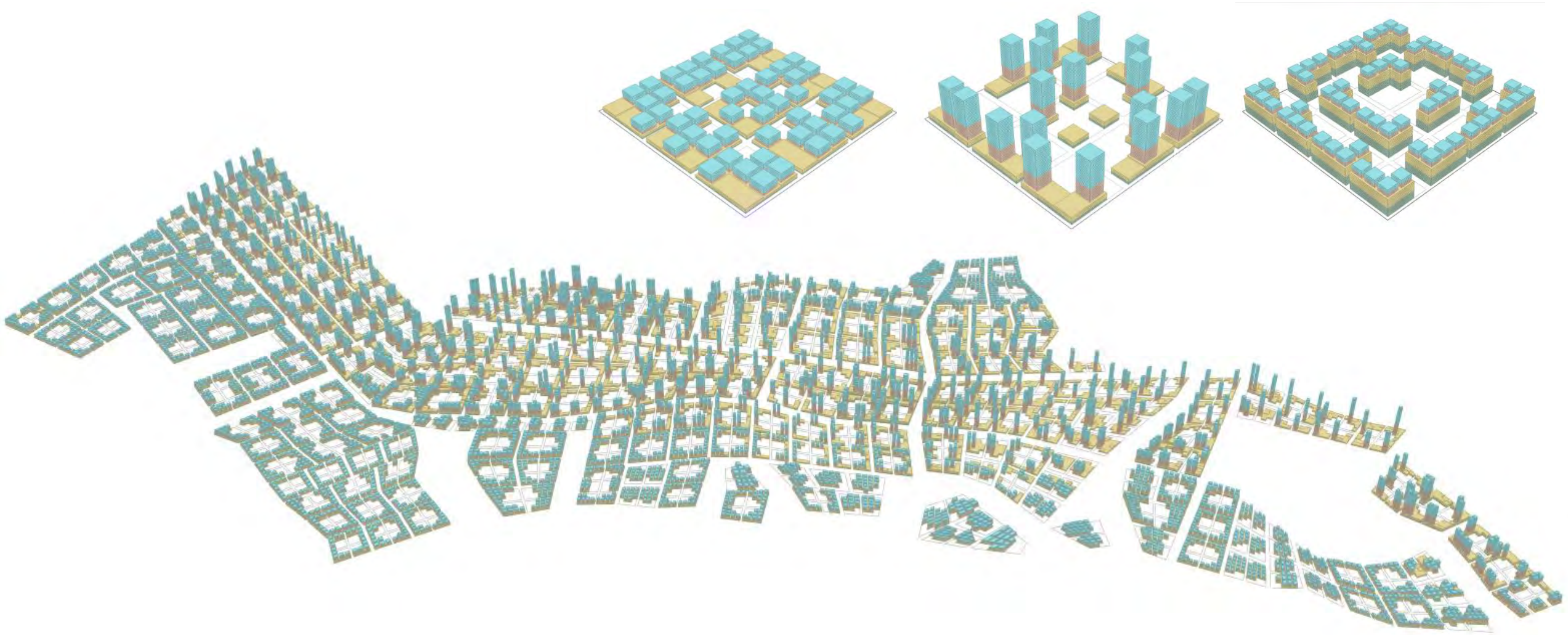

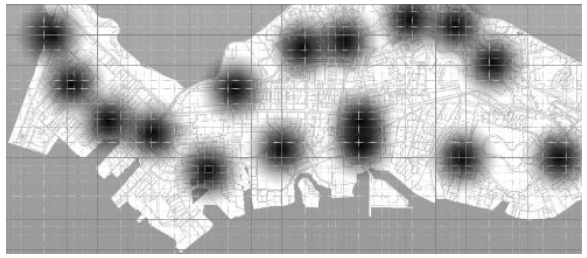

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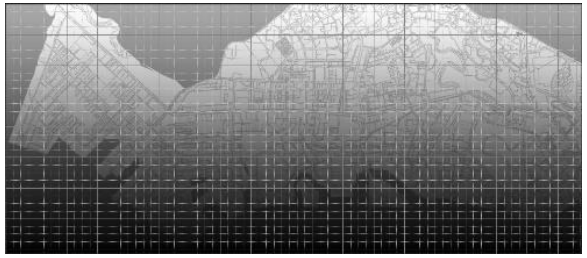

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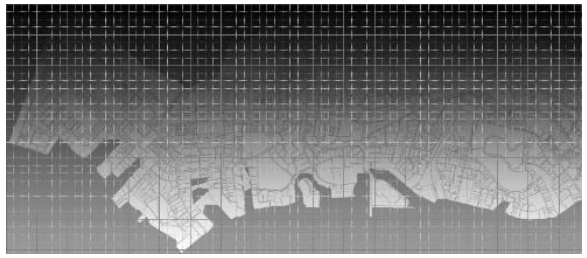

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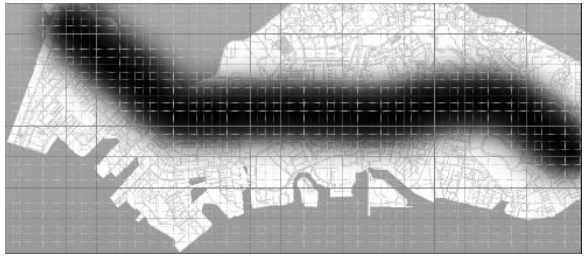
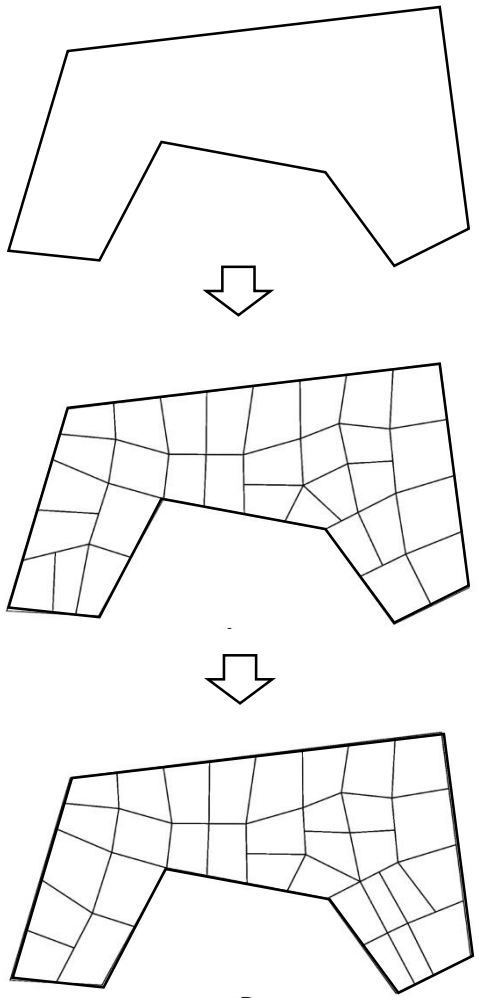
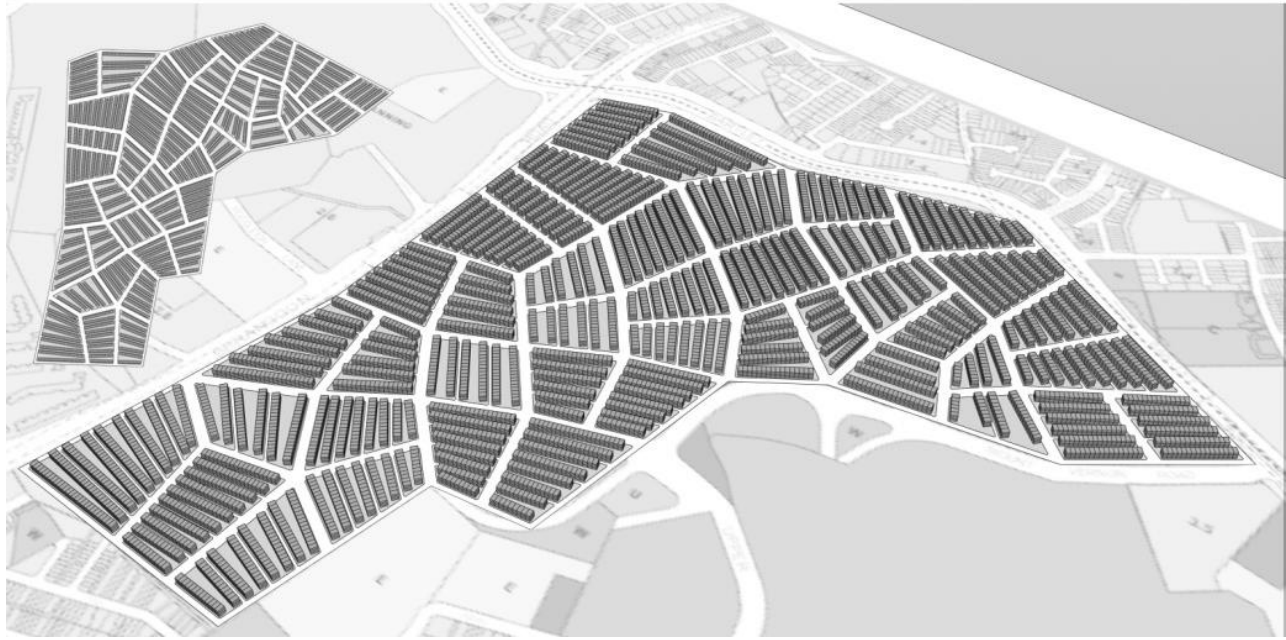


Number of Floors





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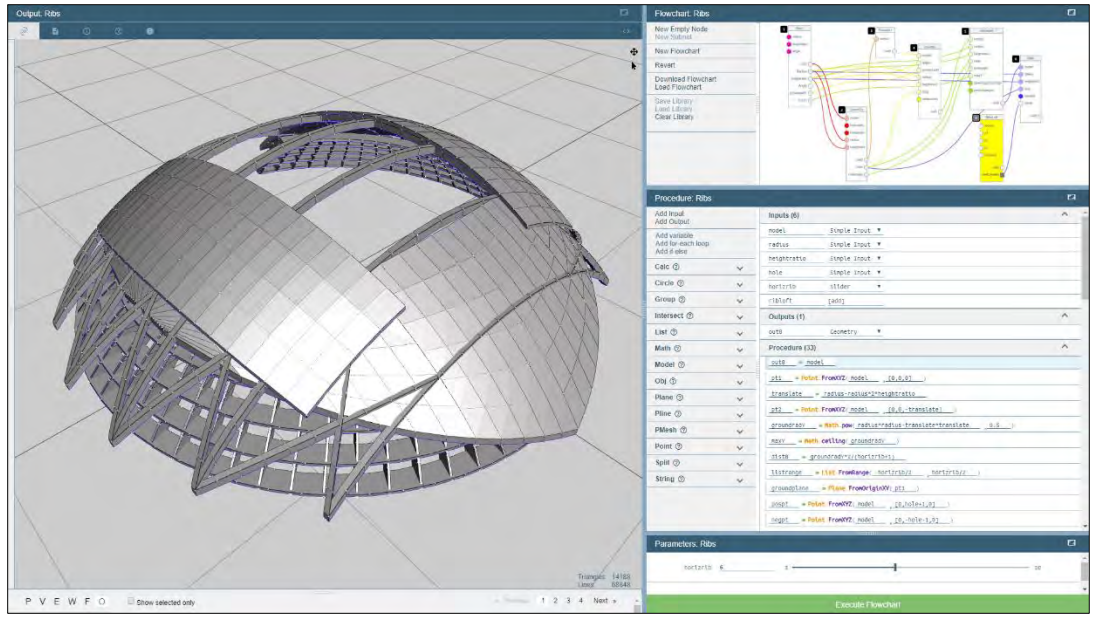
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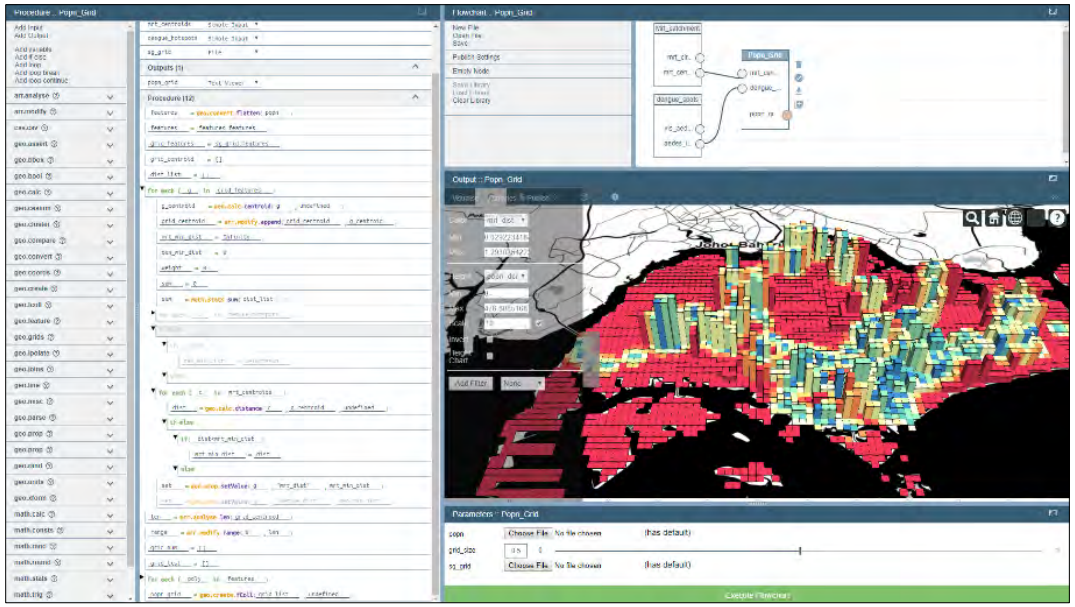
Flowchart: Ribs
Procedure: Ribs
Parameters: Ribs
Execute Flowchart

?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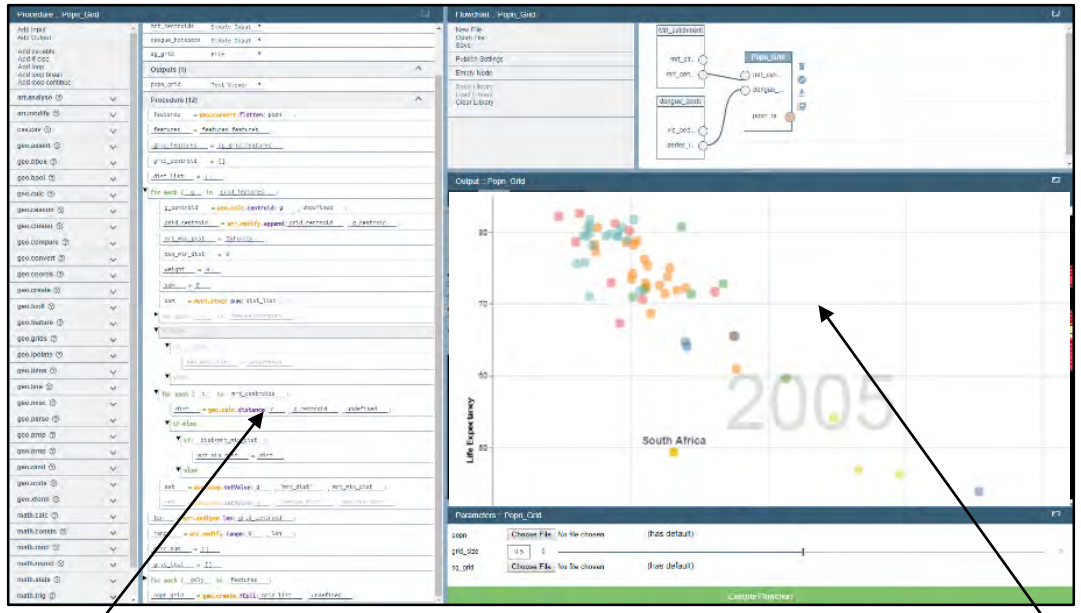
Flowchart: _Popn_Grid
Output: _Popn_Grid
Parameters: _Popn_Grid

Möbius Statistical Modeller



jStat v1.7.1 Documentation

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  - Description
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Overview

Description

jStat is a statistical library written in JavaScript that allows you to perform advanced statistical operations without the need of a dedicated statistical language (e.g. MATLAB or R). It is available for download on Github.

Vega Examples Tutorials Documentation Usage About GitHub

Vega – A Visualization Grammar

Vega is a *visualization grammar*, a declarative language for creating, saving, and sharing interactive visualization designs. With Vega, you can describe the visual appearance and interactive behavior of a visualization in a JSON format, and generate web-based views using Canvas or SVG.

Vega provides basic building blocks for a wide variety of visualization designs: data loading and transformation, scales, map projections, axes, legends, and graphical marks such as rectangles, lines, plotting symbols, *etc.* Interaction techniques can be specified using reactive signals that dynamically modify a visualization in response to input event streams.

Version 4.0.0-rc.3

A Vega *specification* defines an interactive visualization in a JSON format. Specifications are parsed by Vega's JavaScript *runtime* to generate both static images or interactive web-based views. Vega provides a convenient representation for computational generation of visualizations, and can serve as a foundation for new APIs and visual analysis tools.

To get started with Vega, take a look at the tutorials, example gallery, and usage guide, or read about the project's goals. To create common statistical graphics in a more concise form, check out Vega-Lite, a higher-level language built on top of Vega.

Need help or want to share examples? Join the Vega discussion forum or the Vega Slack organization!

Global Development Example

Interactive timelines for global health and economic development data: grab a point to drag it through time! Based on the DimpVis technique by Brittany Kondo and Christopher Collins, *University of Ontario Institute of Technology* (2014).

design-automation.net